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Getting the Most Out of Your Machine Tool Dollar

By Percy S. Brown

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We are constantly searching for knowledge of the latest technique in the use of machinery and tools in order to produce a quality product. We aim to get the best of machinery, materials and supplies and we try to base our advance on fact, not opinion, preferring engineering investigation to the trial and error method. Whatever measure of success we attain is largely dependent on our being constantly posted on development in the machine-tool industry and upon our use of this information

PRODUCTION of portable typewriters and adding machines is a problem of quantity production of products which are not subject to frequent changes of major design, but are being constantly improved through minor design changes. For this reason major emphasis rests on matters of tool design studied in conjunction with the most approved methods of procedure, and this emphasis proceeds back through the tool to the machine.

Considerable stress, therefore, must be laid upon the importance of tool design and production. For this reason, our staff organization is such as to place all responsibility for the design, building and maintenance of tools in the hands of a production-equipment engineering department. This department also is responsible for the maintenance of machine tools.

In producing typewriters and adding machines there are certain procedures very closely allied to the machinery and tool end and it is well to have the contacts thoroughly understood. First, part design comes from an experimental and designing department, a staff branch of the general administrative organization. This department specifies through blueprints the part design and the raw material required in its production.

At this point, the production-equipment engineering department comes in through its tool-designing section, which makes the tool design and issues information to a methods division of our planning department on the width or diameter of stock required. It should be remembered that the experimental department can only specify grade of material and finished thickness, but not such things as width or diameter because they are affected by tool design.

Determination as to use of tools and correct manufacturing procedure is made by the methods division, with a very close tie-up with the production-equipment engineering department. Therefore, where tool design does not follow an obvious and practically predetermined procedure, there is consultation between the two to determine the operations that will be performed and their sequence, these being specified, of course, by the methods division. The latter also issues specifications for the material to be used in the manufacture of parts on the data received from the tool-designing division.

It will be seen from this that particular emphasis is laid on methods, and for this reason no machine or tool is allowed to function on a production basis until passed upon and accepted by that division and under production conditions.

The procedure, therefore, is that the production-equipment engineering department will set up and operate the tool and will operate the machine under production conditions, making sure that everything is absolutely satisfactory before calling in the methods division to accept it. As soon as the latter has accepted the tool or machine and has approved all of the methods involved in the production of the parts,

for which it is used, or for the particular set up, a release is given to an instruction-card division of the planning department for them to make a time study and set the rate.

The tie-up, here, between the three units involved, must be very close because of speed limitations imposing restrictions on both methods and production capacity, and because of other limitations imposed on the part of both machines and tools. Such limitations may be great enough to warrant scrapping or redesign of machines or tools, the suggestions for such procedure emanating from any source, but as a rule coming from either methods or production-equipment engineering.

If there were not a close tie-up between the various departments involved in manufacturing procedure, we would have the problem of the methods division being possibly biased toward methods without true regard to machine limitations, and the consequent problem of frequent decisions on the advisability of scrapping and replacing tools and machines. On the other hand, were too much authority granted to the production-equipment engineering department there would always be the possibility of too much emphasis on tool design or machine utility without regard to questions of speed and resulting economy, or to subsequent operations.

Contact with the Latest Procedure Is Essential

It can be seen that both departments must keep well posted on best manufacturing procedure, and therefore must necessarily keep pace with all developments in the realm of machine tools as well as small tools, fixtures, and allied equipment. Our factory is located away from other industrial centers, and out of the path of the general flow of salesmen. Where salesmen must spend a day to ascertain whether we are in the market or not, it is quite plain that we cannot expect, and do not expect the same degree of attention from them that would be accorded us were we in a city where they could make from three to a dozen other calls in the day.

Lacking this personal contact we find it imperative that our men shall go out to the industrial centers, to industries recognized as having advanced technique in the use of their machinery and tools, as well as to conventions where machine tools are displayed for information.

This, of course, is supplemented by reading the technical publications which deal with the machine and tool problem. Our scrutiny of such publications is primarily of the editorial items and the descriptions of new developments in the utilization of tools and new units in the field of machine tools. We give careful consideration to machine productivity, as well as to specifications, and lay special emphasis on this when following up leads in letters to manufacturers.

All negotiations with reference to the purchase of anything at all are conducted through our purchasing department. This leads to either a call from the representative of the company written to or written specifications and other information. Upon receipt of this the purchasing agent invariably calls in the heads of all staff departments interested, as for example, the production-equipment engineering department, the methods division, and in important cases, the works manager, the planning engineer, and the head parts inspector. In some instances the head of the experimental and designing department, and, in many cases, the works engineer are also consulted.

Purchases of machinery are rarely made until these advisory groups have met, usually with the salesman or engineer of the vendor, and have unanimously agreed upon the purchase. Such conferences necessarily bring out all points regarding the functioning of the machine, all possibilities of tooling it, questions of special tools or fixtures needed, and the productive capacity under the various conditions for which it is to be purchased.

Having determined upon the purchase, the requisition issues from the production-equipment engineering department, passes to the works engineer for his information and to enable him to provide necessary pulleys, special drives, or whatever else may be needed, and to arrange for setting it up on arrival. The requisition is then approved by the works manager, goes to the purchasing department, and the purchasing order results. The works manager requires, however, that all requisitions shall be supported by a complete report from the methods division or from the production-equipment engineering department as to the need for the purchase, the cost, savings to result from its use, and all other information bearing on the purchase. This is needed for a permanent record.

Owing to the very fact that so much emphasis is laid upon methods, and because we do endeavor to advance with all advances in production technique, the problem of machine and tool obsolescence is quite important. We have no hesitancy in scrapping a machine or tool, providing it can be shown that such scrapping is beneficial. Each case must be carefully analyzed and acted upon independent of all others.

All Mechanical Equipment Is Under One Head

All mechanical equipment is maintained through the production-equipment engineering department. Tools are issued from the tool crib to the production department who makes the lot of parts called for, and they are then returned to the tool-inspection department accompanied by from 10 to 25 of the last parts made with the tool. The slip accompanying the tool records any trouble noticed by the supervisor or parts inspector, and the tool inspector reads the slip to see whether any such information is recorded. He may then check the part against the part print and go over the tool before placing it on the shelf for the next order or sending it to the toolroom to be repaired or reconditioned. If it is sent to the toolroom it must come back and be approved before going on the shelf or being issued to a production department.

Machines are repaired by special men of the toolroom staff, and except for rare major breakdowns our repair service can maintain most machinery and equipment in such condition that it will be in serviceable condition for many years after being written off the books. Of course, there are many instances where machinery is scrapped, physically removed from production departments, and placed in the hands of the purchasing department for possible sale while the machine is in practically perfect operating condition. This will be due to the obsolescence factor in almost all cases, resulting from changes in methods, changes in design, or replacement by better adapted machinery.

It is not our practice to enter the used-machine market except under conditions such as a shortage of machines, the need for immediate delivery which cannot be met by the manufacturer, or some other exigency. As a general rule we are sellers of used machines, and not buyers of them.

It might be well, at this point, to mention that from the standpoint of costs there are some very important high lights. First, the first cost of a machine is of minor importance. What we are interested in is the machine's productive capacity, its adaptability to our work, its ability to perform under our conditions, and to stand up satisfactorily under such conditions, and, of course, its flexibility from the standpoint of tooling. Then there is that element of more or less intangible cost, the element of limitation of operators' speed by machine speed versus operators' capacity to increase production due to a machine speed exceeding ordinary human ability. The cost of spoiled work resulting from wage incentives is also a consideration.

If it can be shown that the purchase of a machine will result in savings that would cover the purchase price and interest in a period of two years, it would have an immediate appeal. If the machine had a utility beyond the immediate reasons for purchase it would be a factor weighing in its favor and against a single-purpose machine. We like flexibility in this respect.

Much has been written about loyalty of buyer to vendor, and we are among those who feel that this loyalty—all things being equal—is right. Whether it be the purchase of material, supplies or machinery, the representative of the vendor is, as a rule, very well informed on his product, technically trained where such training is necessary, and both capable and willing to soundly advise the buyer in his purchases. As it is to his advantage never to over sell, either in quantity or performance, because he hopes to maintain perfectly satisfactory relations with the buyer, his advice is very valuable.

We Maintain Friendly Contact with Our Sources

It is, of course, to the advantage of the buyer to maintain such friendly relations, and to capitalize the knowledge thus made available. We have found that this practice has been of inestimable value, in that salesmen make it a point to keep thoroughly posted on our procedure, and to advise us of any developments in industry which they think would be advantageous to us. It may be something new in materials, it may be something special in supplies, or it may be an improved design or a new fixture, or an entirely new product in the field of machinery.

Where possible, we secure quotations from vendors of the same product but, of course, from vendors of our own selection, because we may have, and frequently do have, more or less fixed ideas as to what machines we desire to install. Where competitive bids are invited we expect that they shall be complete in every detail, and final as to price quotation. We seriously object to the practice, which still exists in some scattered instances, of playing one vendor against another to get reductions in bids, and, at the same time, we are suspicious of a firm which will come back with a new proposal at a lower figure when told that the order will be, or has been, placed elsewhere.

Some sellers still believe that orders are placed primarily on the basis of price consideration, whereas it is perfectly obvious that this is only one factor, and that it may be removed from practically all consideration if primary emphasis falls on adaptability or productivity.

All of us in industry are confronted with the problem of being offered goods of like value and equal price from many sources, and although we would like to buy from them all it is obviously out of the question. Frequently, there is no choice between them, and in such instances we are inclined to, and usually do, stick to our usual source of supply. Where we give consideration to a product from someone other than our regular supplier, we give an opportunity to that supplier to quote before making a commitment.

We like to have contacts with all of these sources of supply, we like to have friendly relations with them even though we do not buy, and were it not for our geographical limitations we would, no doubt, have many more contacts of value than we have now.

As stated, the purchasing department largely depends on the technical staff from the factory when matters of a technical nature must be discussed with suppliers. When such meetings are held with suppliers, all necessary consideration is given to limitations imposed by design, physical or other requirements, and we are enabled to properly specify what is required, thus leaving the purchasing department in a position to determine upon sources of supply. Where this technical investigation discloses limitations as to firms or particular product, such limitations are imposed on the purchasing department by the factory, but with as broad a buying range as possible under the circumstances.

We Cut the Red Tape for the Salesman

I have touched upon the fact that the purchasing department invariably calls in advisors, and, although that is true in the early stages of these contacts, we make no pretense of keeping up such a formal relationship after the representative of the distributor becomes well acquainted with the members of our organization. When this happens he can feel perfectly free to go directly to any member of the organization and discuss his product, but he never fails to go out through the purchasing department if he did not come in that way.

It makes absolutely no difference whether an order is involved or not, the salesman does it as a matter of courtesy—a natural instinct among practically all of them. When salesmen do come who are not familiar with our procedure and who think that they must get to an order through the back door, the man that they reach in the factory organization greets them with courtesy, ascertains that they have not come through the purchasing department, explains our procedure, and either directs them to the purchasing department or leads them there. Within one or two minutes they may be back to where they started, but only with the knowledge and at the request of the purchasing department.

Finally, much information comes to us through people who visit our plant, and who in going from department to department will here and there drop suggestions or will even ask to see a department head interested in the problem in order to volunteer some useful information. Inasmuch as our factory is open at all times to those from other industries and to salesmen, as well as to casual visitors, and despite our being off the main industrial traffic line, we have many visitors and receive much interesting and useful information.

Throughout this article I have pointed out that we are constantly groping for knowledge of the latest technique in the use of machinery and tools in order to produce a quality product. Of course we aim to get the best of machinery, materials and supplies in

order to produce a product which will meet the exacting demand of the public.

We try to base our advance on fact, not on guess or opinion, preferring engineering investigation to the trial and error method. We really plan and exert every effort to co-operate with other industrial enterprises, and we certainly recognize the fact that whatever measure of success we attain is largely dependent upon our being constantly posted on developments in the machine tool industry and upon our proper use of this information.

[The preceding article is the thirteenth under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article, by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409, Vol. 62. The second, by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521, Vol. 62. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719, Vol. 62. The fourth, by L. C. Morrow, Managing Editor, *American Machinist*, outlining the policies of the International Harvester Co., was published on page 793, Vol. 62. The fifth, by G. T. Christopher, Factory Manager, the Dayton Engineering Laboratories Co., was published on page 907, Vol. 62. The sixth, by D. C. Wright, of the H. W. Caldwell & Son Co. plant of the Link-Belt Co., was published on page 1, Vol. 63. The seventh, by T. C. Vail, superintendent, the Spicer Manufacturing Co., was published on page 175, Vol. 63. The eighth, by B. R. Norris, director of works equipment, the Westinghouse Electric and Manufacturing Co., was published on page 255, Vol. 63. The ninth, by Fred H. Colvin, Editor, *American Machinist*, was published on page 417, Vol. 63. The tenth, by Wm. Bailey, production manager, the Hoover Co., was published on page 917, Vol. 63. The eleventh, by G. S. McKee, assistant factory manager, the Timken Roller Bearing Co., was published on page 995, Vol. 63. The twelfth, by Wm. Hartman, superintendent, the National Cash Register Co., was published on page 1, Vol. 64. Other articles on the same subject will be published in forthcoming issues.]

Protecting the Edge of Cutting Tools

By C. G. Williams

IF ONE will make a study of a cutting tool after hard use, he will find that back from the edge a short distance, in most cases where heavy cuts and feeds have been used and from $\frac{1}{8}$ to $\frac{1}{4}$ in. from the edge, there is a hollow worn out to an extent and depth, depending on the length of time the tool has been used and the severity of the service. This hollow seems to relieve the strain on the tool and also to allow the chip to be more easily curled back on itself. It will also be noticed that after the tool has been worn to a certain extent, the cavity does not become any greater, thus showing that a point has been reached where the least possible pressure is being put on the tool in removing and getting rid of the chip.

Investigation of the tool, while in use, will show that the reason the edge of the tool does not also wear away or become destroyed is that the action of this chip on the edge of the tool really makes a new cutting edge by building up metal on that part between the eroded section and the edge. The great heat generated by the action of cutting any of the modern alloy steels, especially those having a large chromium content, seems to cause a breaking down of the metal adjacent to the tools into its constituents; or perhaps a semi-breaking down only, of a minute quantity of that metal lying against the tool and a conversion of other ingredients from a part of the various constituents of the metal cut.

Just what happens during this apparent breaking down of the metal is not known, but it would seem that the greater part of the ingredients thus released are soldered, through the action of the heat and the great pressure exerted in removing and bending the chip, to the tip of the tool between the cavity and the edge, in this way building up a false cutting edge, that does the work for the true edge of the tool.

It is very difficult to obtain a good view of the metal deposited on the cutting edge because of the fact that it is covered up by the chip, but occasionally a view may be obtained in action. If one is very careful in removing the tool from the metal, after a long period of use, the built-up section can be readily seen. However, if this built-up portion is broken off in removing the tool from the work, nearly all of the sharp cutting edge of the tool will be broken off with it. When the tool is removed from the metal with the built up portion intact, an attempt to again use it will only cause this section to berak off and with it parts of the tool itself so that the tool must be ground before it will give efficient service.

Deposit Forms Cutting Edge

In all cases where special attention has been given to the tool and its action, it has been found that those tools on which this deposit forms are those that give the longest service and perform their cutting most readily with the least strain on machine and tool. In other words, this deposit begins to form on the tool as soon as the cut is started, and continues to build up until it completely fills the cavity that in the beginning is just above the tool as the metal is pried off in irregular masses. It seems to continue to build up until it takes up the office of the cutting edge. From this time on, the chip will roll off more smoothly, the cut will be smoother, the surface of the metal loses some of those little hook like projections that are especially noticeable on modern alloy steels and there is a seeming layer of especially hard metal over it giving a sheen to the surface that will not be seen when the tool has no protective point.

The strain on the tool will be less and a greater amount of metal can be removed before the tool will break down. In fact, it seems as if the life of the tool will be indefinite as long as the false cutting edge is not broken off.

This built-up metal is very irregular and extremely hard, although this irregularity may be and probably is occasioned when the tool breaks out of the metal it is cutting. An analysis of the deposit shows that it is a double carbide of the alloyed constituents of the steel.

When an attempt was made to grind this deposit from the point of the tool it was found to be so hard that the corundum wheel was scored and guttered to quite an extent before the metal under the deposit had been worn away and the deposit was broken off to be retrieved and analyzed.

It is not the intention to put this data before the readers as definite, but only as a tentative theory that the shape of the tool does not make the great difference that some would have us believe, that the long life of some tools in influenced by their ability to gather this deposit on the cutting edge, and its ability to take over the work of the cutting edge.

Stainless steel should be annealed before attempting to machine it. Heat it to from 2,400 to 2,500 deg. F. and hold at that temperature for an hour, then allow it to cool in the open air, but not in a draft. It can also be cooled in oil without appreciable hardening. When so annealed it machines about the same as 3-per cent nickel or a nickel-chrome steel.

Some Multiple-Operation Press Tools

By W. E. Irish
Associate Editor, *American Machinist*

A two-draw cup-forming tool — Blanking center-holing and forming combined—Forming a cylinder in a side-acting tool — A universal four-way tool

THERE is often the opportunity, in designing tools for press work, particularly on light-gage metals, to combine single operations to advantage. The tools here described are illustrative of this point which is often overlooked in laying out the logical sequence of the work and in making the most of the capabilities of the press equipment.

In Fig. 1 is shown a tool set-up viewed from the rear of the press, for making a cup of 28-gage sheet metal that requires two drawing operations to complete the form. Samples of the intermediate and final forms are shown perched on the hold-down bolts for the dies. The press is double acting and contains an attachment to actuate a pusher to transfer the parts as they are completed in the first die over to position for the second form. The first die, to the left, is located above the other an amount sufficient to permit the pusher to move the work horizontally from under it to rest on top of the second draw ring. Here it is pushed through the second ring.

The tool layout is shown, and a general idea of construction and relative motions of the parts can be gotten by comparing the illustration and the cross-section of the set-up given in Fig. 2, in which latter the press is shown in half section at the bottom of the stroke and in the other half at the top.

In order to be able to adjust and maintain the correct pressures on the work for each operation, provision has been made for independent movement and locking of the two blank holders. The first of the holders is square on the bottom to rest on the flat blank, while the second is beveled at 45 deg. to conform with the similar bevel put in the bottom of the cup by the first operation.

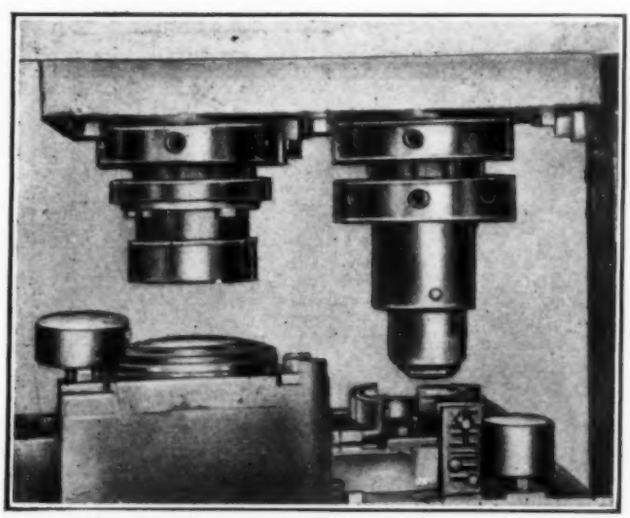


Fig. 1—The two-draw, cup-forming tool

Just below the draw ring in each die is a stripper ring, as illustrated in the enlarged section, which acts effectively to hold the work as the punch is withdrawn.

This stripper is made as a complete circle of inside diameter equal to that of the punch with which it is to work and is beveled on its upper surface to clear the downward path of the punch and the parts. It is cut with a semicircular groove in its outer edge to take a light coil spring which completely surrounds it. The spring is under tension. The solid ring is finally cut into four sections which, held together by the spring, are assembled in the tool below the draw ring with sufficient clearance to allow for free lateral movement. When the work passes through, the sections move back against the action of the spring and increase the center-hole opening. They close in as soon as the work has gone by and act to strip it from the punch against their lower square corners as the punch returns upward. In the first operation the cup measures approximately 4 in. in diameter by 2 in. in height. The second pass reduces the diameter by 1 in. and increases the height to approximately 3½ inches.

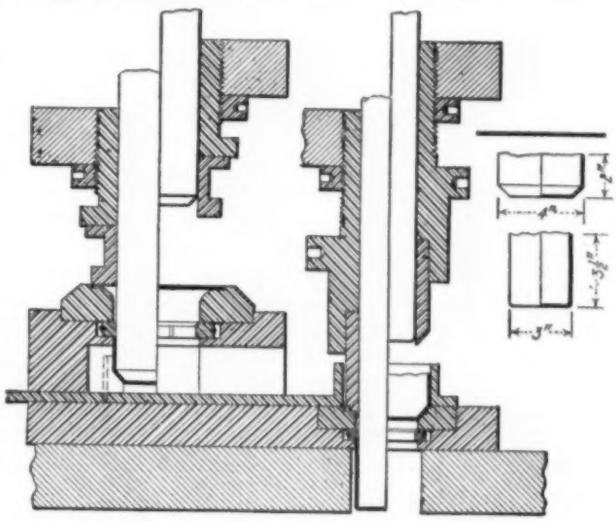


Fig. 2—Cross-section layout of the two-draw tool

In Fig. 3 is pictured another example of a multiple-operation tool in which a blanking, center perforating and forming operation are combined. In Fig. 4 is a cross-section of the tool to indicate its construction and to show the action. The piece is blanked from scrap resulting from another part and is 28 gage in thickness.

Fig. 3—A tool that combines blanking, center perforating, and forming

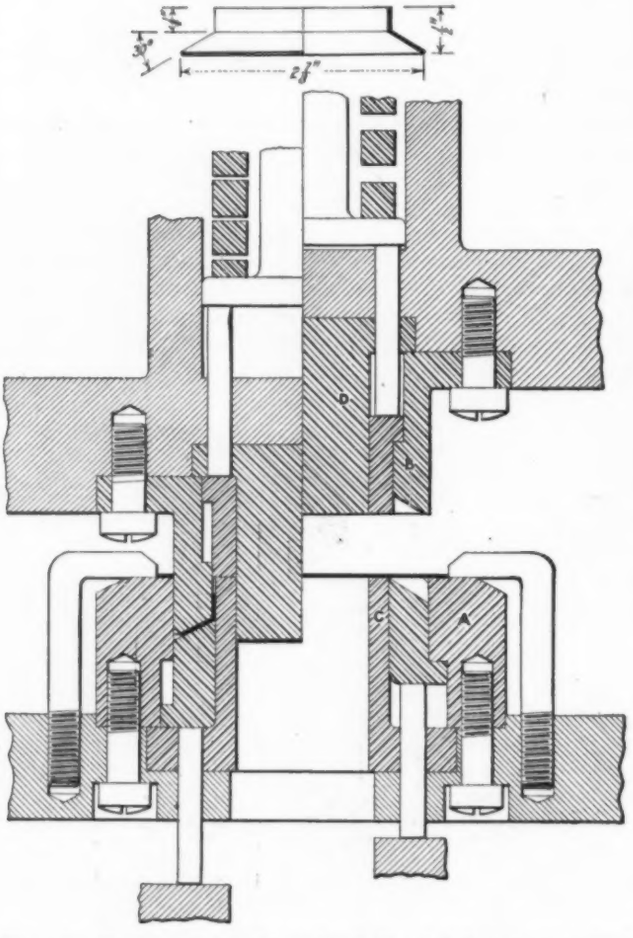


Fig. 4—Cross-section layout of the triple-purpose tool

The blank measures 3 in. in diameter. The finished piece, which includes a center cylindrical portion and a skirt at a 30-deg. angle, stands approximately ½ in. in height.

The part is blanked, Fig. 4, between the outer die *A* and the outer punch *B*. This punch, as will be noted, also acts as the forming punch for the finished part. Simultaneously, the center hole is blanked between the inner die *C* and the inner punch *D*. The outer edge of the die *C* acts as the form over which the part is drawn against the pressure of the blank holder *E* to form the vertical walls.

Before the draw starts, however, the outer punch *B*, after cutting through the slot, forms the blank down on its inner surface against the stripper *F*, which also acts as the bottoming form for the skirt section of the part. The metal is gripped between the punch and the stripper with sufficient pressure to prevent any slipping as the continued downward movement of the punch completes the draw. On the return stroke, the blank holder strips the punch and the bottom stripper brings the finished part out of the die, where it is dropped into a container.

There are many possible applications for this type of tool where blanking, perforating, inner flanging and outer flanging can be done simultaneously. The limiting factor, as can be seen, is the ratio between height of flange and thickness of material as affecting the strength of the parts *B* and *C*. The rate of production is normally 20 per minute on the piece in question.

A cylinder-forming tool and the work it produces are illustrated in Fig. 5. The piece, which stands approximately 4 in. in height by 1½ in. in diameter, would ordinarily present difficulties in securing a uniform bend on account of its peculiar outside contour and the fact that it has been considerably weakened by the perforations. It certainly could not be treated in the ordinary manner. The stock is 20 gage.

The tool consists of a stationary upright spindle over which the part is shaped and two slides set on

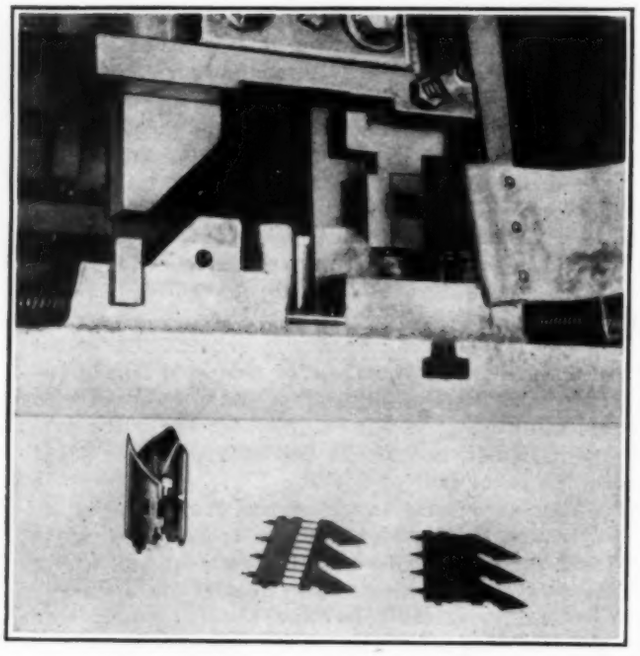


Fig. 5—The cylinder-forming tool

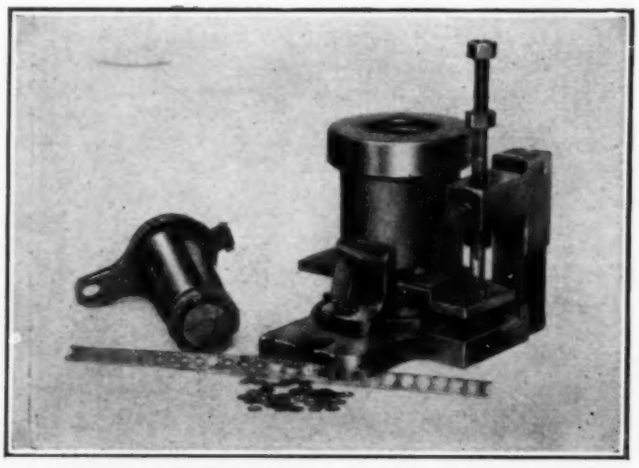


Fig. 6—A compound, sub-press tool and stripper

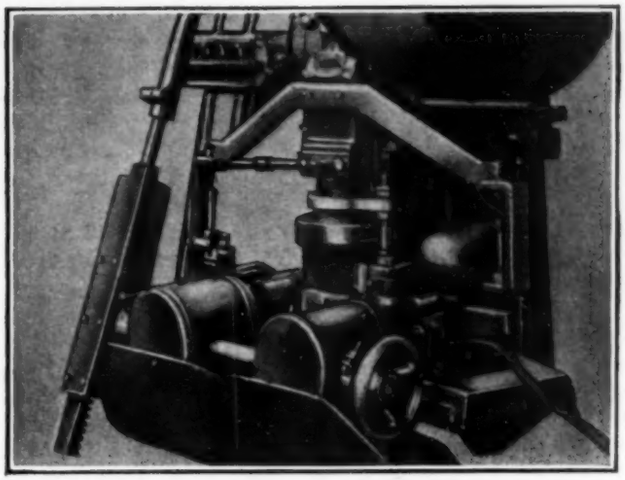


Fig. 7—The sub-press tool set up with a roll feed

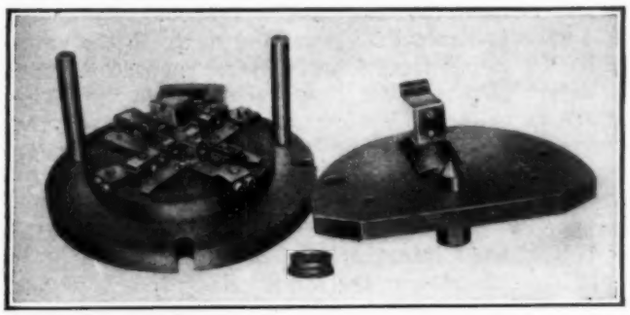


Fig. 8—The four-way, horizontal perforating tool

opposite sides of the spindle, each carrying one-half of the outside form. The slides are normally held away from the spindle by compression springs which are mounted outside of the die shoe. The part is set on its edge between the spindle and the slide to the right.

In the ram of the press, two wedge blocks are mounted to close in the slides. They are set so the right-hand one engages, moves in, and backs up the right-hand slide to form the part to a U shape around the spindle before the left-hand slide is forced in to complete the circle.

After the operation is completed, the operator removes the finished work by sliding it up from the spindle by hand and inserts another blank on its edge. Production can be maintained at the rate of approximately 20 per minute with an experienced man.

In Fig. 6 is shown a compound sub-press tool for punching a small star wheel from brass strip. This tool, so far as it alone is concerned, is a standard design similar in principle to that described in detail on p. 177, Vol. 63, of the *American Machinist*. It punches the work out of the strip and then returns it to the scrap as a convenient means of transportating it from between the punch and die without individual handling. An addition has been made, however, which is not so common.

The assembly shown to the right of the main tool, which consists of a guiding frame, spring plate and threaded plunger, is used to separate the parts from the scrap as the strip feeds through below the plunger. The design is simple enough, and in fact is one of the little, but saving, details so often overlooked just on account of its simplicity.

The tool is shown set up in Fig. 7, where the plunger attachment to the ram can be seen. An automatic feed is included so that after the operator has inserted the strip from a reel he can start the press and let it run without further attention. The pieces are blanked out, returned to the strip and again removed from the strip as the latter feeds under the added plunger. The scrap then feeds to the side while the parts are directed through a chute to a container on the floor.

It is often necessary to punch one or more sets of holes around the rim of cylindrical parts, and there are numbers of cases to make the problem more complicated in which these holes are in different diameters.

Many forms of single punches and jigs, indexing tools and multiple punches have been designed for this class of work, a good example being shown in Fig. 8 of the last-named type.

The punch, to the right, consists of a plate which carries a center pin for expanding an inner set of slides that carry punches to perforate two sets of holes on two diameters and simultaneously in four directions. A piece of the work is shown in the illustration, and the holes, which are in this case slots approximately $\frac{1}{4}$ in. in width by $\frac{3}{4}$ in. high, are indicated. While the pin expands the inner punch slides the finger in the punch plate, enters a block secured to a ring on the die and rotates it to bring closing wedges against four corresponding outside slides carrying the perforating dies. By means of this construction, varying diameters can be worked on successfully, and even though the smaller dimensions occur at points which would interfere with stationary tools and prevent work being placed or removed, this tool can be used to advantage within its range.

A closer view of the die is given in Fig. 9 to better illustrate its construction. The punch and die slides in the die-closing ring are held in place by the 8 flat plates which meet in pairs at the center of the tool. Set into these plates where they join are pairs of work locating pins, as can be seen.

The slide construction has been made with a view of making as universal use of the tool as possible, as well as to facilitate punch and die maintenance. To this end, the slides are split and are machined with a dovetail on their ends to take the holders, and a bolt across the split clamps them in place. Additional clamps are provided to hold down against the die holders. Another feature to assist in universal application is the adjustable wedge block construction for actuating the outside slides. The movable part of this wedge

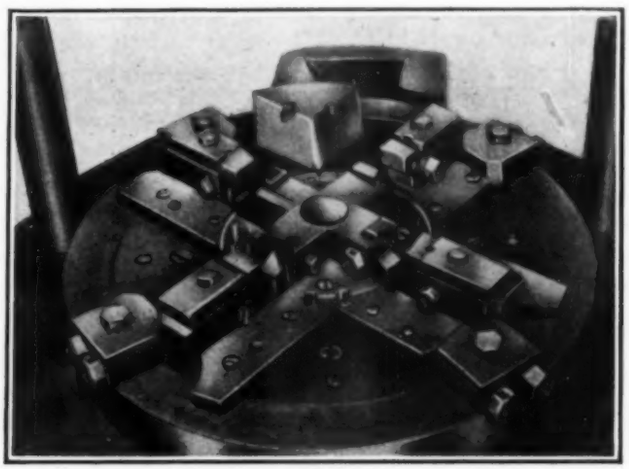


Fig. 9—Close-up view of the four-way die

block is held down by a bolt set in an oblong slot while it is moved and backed up by means of two screws and locking nuts. The tool offers a number of possibilities for multiple press-work application.

In the Cleveland Metal Products Co. at Cleveland, Ohio, where opportunity was afforded and assistance given to secure the photographs, there are many other examples of operations which the engineers have designed and installed and further numbers that are being, at present, worked out. The company offers an excellent example of the results that can be obtained when the attitude is one of discontent to let an old process or a number of operations remain as they are just because they operate.

Reducing the Dead Weight per Passenger—Discussion

By E. Andrews

THE editorial under the title given above, published on page 32, Vol. 63, of the *American Machinist*, is undoubtedly worthy of study on the part of all automobile and railway engineers, since there is, today, a strong impetus for the construction of much lighter automobiles, motor-coaches, and passenger cars.

The weight given in the editorial for a standard railway car is very great indeed, especially when British railway cars weighing as little as 600 lb. per passenger are being constructed. These cars weigh approximately 29 long tons and have seating accommodations for 108 third-class passengers. A number of all-metal cars weigh as little as 700 lb. per passenger, and have a total approximate weight of 30 long tons. The seating capacity is for 95 passengers. In the all-metal cars, the framework is of steel; the paneling of the sides and roofs is made of aluminum sheets; the interior work is finished with moldings of drawn steel and aluminum alloy. The ventilator and electrical fittings, together with all the inside furniture of the cars, are in polished aluminum. A fundamental advantage of aluminum and light-alloy steels in car construction, is the lessening of the dead weight, especially in the case of electric trains subject to frequent stops, where rapid acceleration and retardation are essential, is of great commercial importance.

Lightness is a prerequisite of a vehicle, in that if it is too heavy, its cost of operation is too great. The present high cost of fuel, lubricants, tires and other running charges, which vary in proportion to the weight to be carried, makes it essential that the dead weight per passenger be reduced to a minimum.

Experience has shown that the use of aluminum instead of steel for the side panels and roof sheets of an electric-railway passenger car will provide a return of 20 per cent per annum, based on the reduction of average ton-miles, interest on the increased initial outlay, and the following weights:

Electric Railway Passenger Car 63 ft. 7 in. long:	
Steel, No. 16 gage (0.064 in.)	2,865 lb.
Aluminum No. 14 gage (0.080 in.)	1,242 lb.
Saving in weight	1,623 lb.

Some indications are not wanting that the advance in the utilization of materials in aëronautical construction, has not passed unnoticed in other fields of engineering. As is well known, there is an obvious link between aircraft and the motor vehicle, if only in the fact that the internal-combustion engine is an essential factor of both. It is, therefore, not surprising that the automotive engineer should be one of the first to utilize the advances of the aëronautical constructor, in order to lighten the motor vehicles which he has to design and construct. By the careful choice of materials and by the study of their behavior, this desired result can and will be achieved.

In all moving vehicles that have to be started and stopped, there is great room for overall economy by reducing dead weight, even if the first cost should be increased, and what applies to the automobile or railway car as a whole is equally applicable to individual moving parts, particularly reciprocating parts. In the locomotive, for instance, the difficulty of balancing is rendered more serious by the great weight of coupling and connecting rods. However, in some cases, heat-treated chrome-nickel steel has been adopted for these parts with good results. Reverting again to the automobile, or motor bus, noteworthy in connection with the design of wheels for heavy vehicles are the satisfactory experimental results recently obtained by the London General Omnibus Co. with aluminum-alloy wheels. Tests of over 30,000 miles and on twenty different routes have shown them to be quite as satisfactory as steel wheels, while, since their weight is only one-half of the latter, the effect of unsprung weight is minimized. Moreover, the scrap value of such wheels is approximately two-thirds of the original value.

Pressed sheet metal (aluminum and steel) is also making a great contribution to the automobile and railway-car industry in speeding up the production of parts, reducing unnecessary weight, eliminating many expensive machining operations, and saving material and handling costs, in addition to the saving in plant investment that would have to be made to take care of many finishing operations required when cast parts are used.

In conclusion, it should be stated that modern aluminum alloys are remarkable, and that their general use for every kind of moving machine and many structural purposes is bound to come ultimately. Bulk for bulk, these alloys are as strong as the ordinary mild steel of commerce, are one-third the weight, and can be machined in less time and with much less wear and tear on the tools. For many years, lack of strength retarded the progress of aluminum alloys, and it is only during the last decade that production of the strong alloys on a large scale has been carried on. Indeed it may safely be said that the strength of modern aluminum is not yet realized by the engineering profession, but within the next decade the activity of the big producers will undoubtedly overcome all prejudice against these alloys. When this happens, aluminum will certainly rank next to steel and iron as the most largely used metal. In 1912, it was not possible to obtain with an aluminum alloy a greater tensile strength than 30,000 lb. Now a strength of 90,000 lb. is possible and the elastic limit has correspondingly risen. In the matter of resistance to corrosion, it is vastly superior to steel. The cry is ever for a better ratio of power to weight in the automobile and motor-bus; also, by the employment of modern aluminum and steel alloys, the dead weight of railway rolling stock can be reduced to a very appreciable extent.

Automotive Production

Willys-Knight Production Methods

By Fred H. Colvin
Editor, *American Machinist*

Individual heads that carry special packing rings over which the inner sleeve passes—How the wide multi-ground rings are made

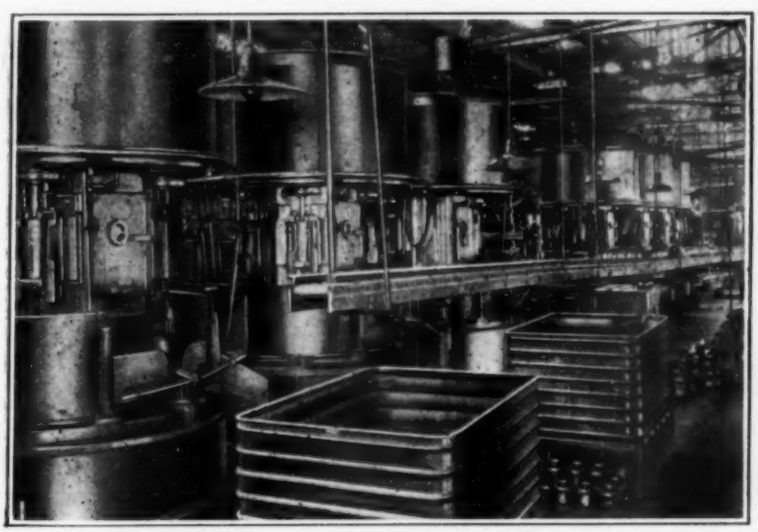
Cylinder Heads

THE only points of similarity between the cylinder heads of Willys-Knight engines and those of the poppet-valve type is that they are both removable and both must make a tight joint with the cylinders. Instead of one head covering all the cylinders, the Knight engine has a separate head that goes down into the cylinder bore and carries two packing rings over which the inner sleeve passes on each upward stroke The head has a flange that makes a tight joint with the top of the cylinder block, and is held in place by four or six studs. The lower, or inner end of the head also forms the combustion chamber and is finished all over. The spark-plug hole is tapped in the center.

The practice differs in the 4- and 6-cylinder engines, the heads for the former being of cast iron while the 6-cylinder head is of aluminum and cast in a permanent mold.

The cast-iron heads are machined on Bullard Mult-au-matics, a battery of six machines being shown in Fig. 1. The inclined roller conveyor carries the work from one operator to the next. Further down the line there is a second conveyor beneath the first, carrying work to an inspection bench for preliminary checking up—for the heads play an important part in the proper functioning of the engine and are held to very close tolerances. Fig. 1 also shows the corrugated-steel boxes in which the castings come from the foundry.

First, the end of the head that enters the cylinder is turned, and then the spark plug hole is drilled, after which the other end is roughed out and the casting inspected and water tested. Then a small groove is milled in the upper edge for the copper tube by which the water is siphoned out of the water space in the head, when draining the water jacket. The spark-plug hole is then tapped and the outer end of the tube surrounding its spark plug is threaded for the cylinder-head nut. Four ½-in. holes are next drilled in two heads at once, using the double fixture in Fig. 2. This fixture



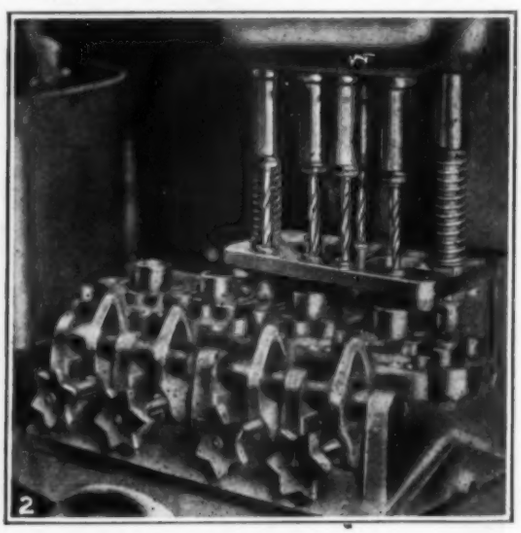


Fig. 1—Machining heads on Mult-au-matics. Fig. 2—Double drilling fixture

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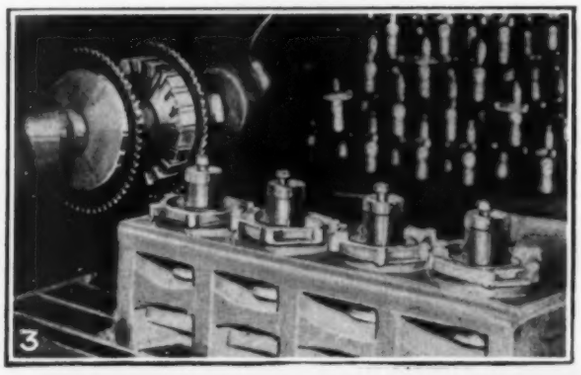
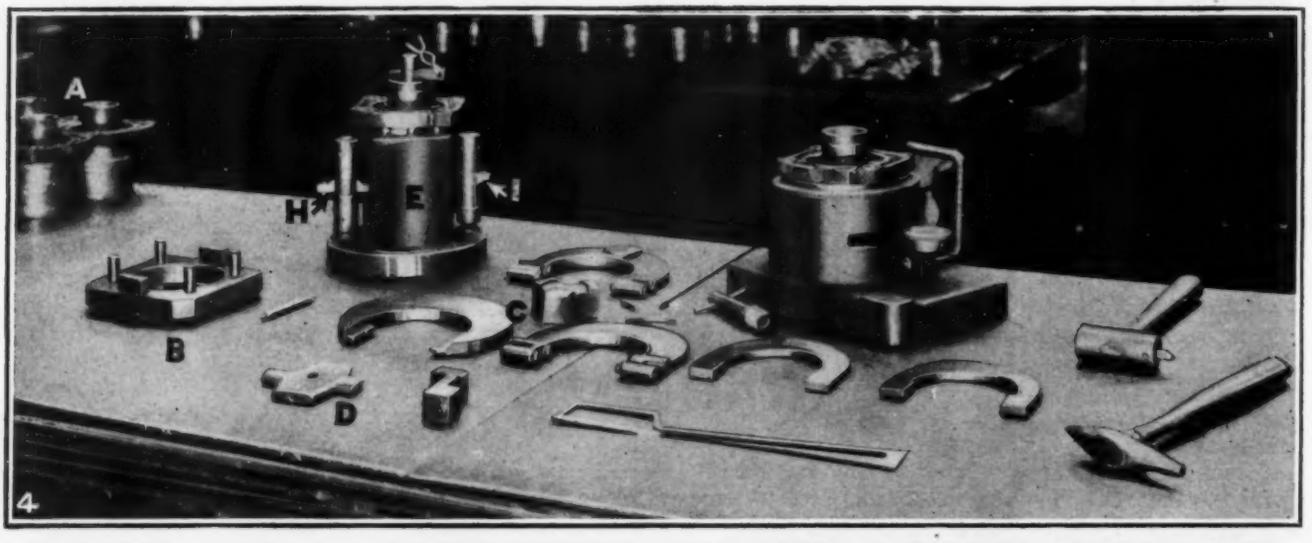


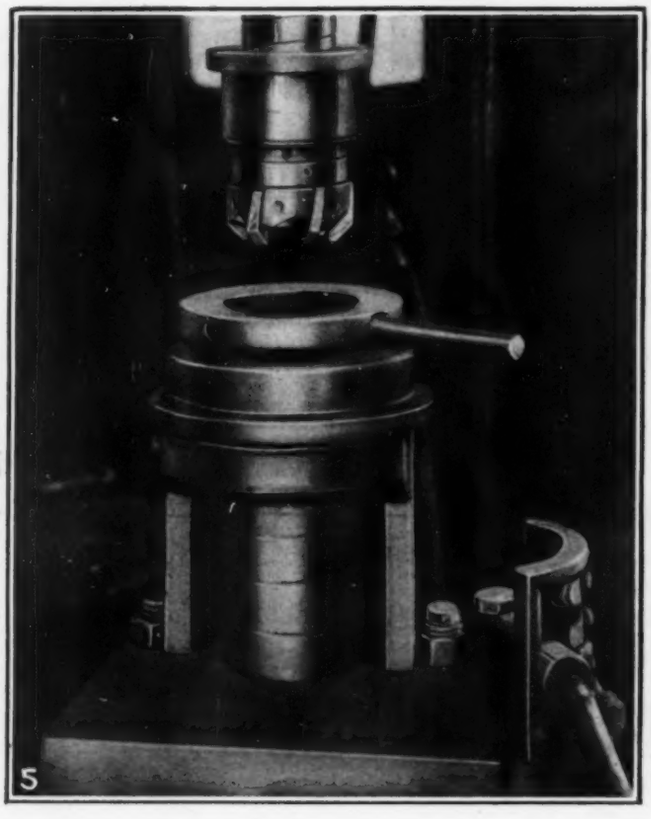
Fig. 3—Milling and facing sides

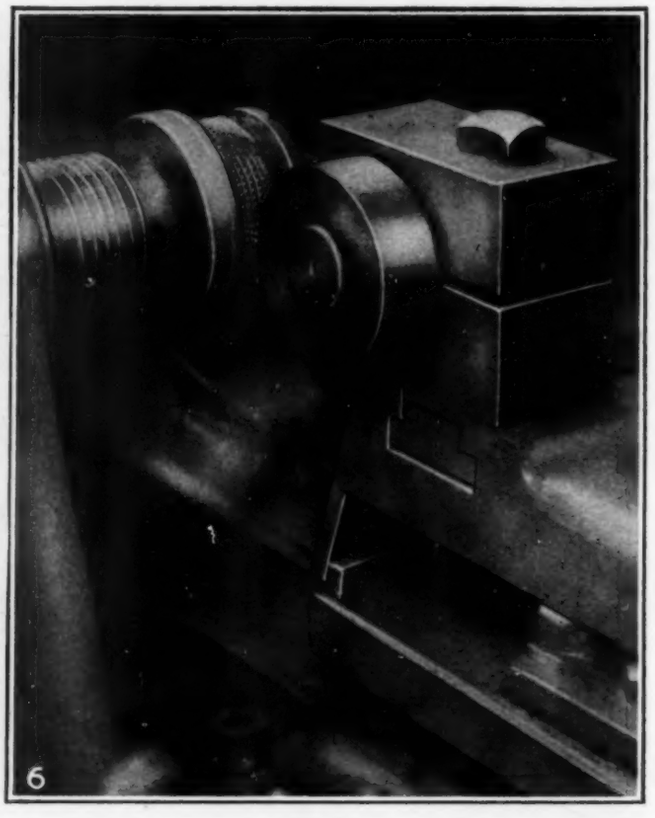
Fig. 4—Some of the inspection gages

Fig. 5—Boring four rings at once

Fig. 6—Knurling or peening rings







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holds four heads, so that while two are being drilled, two more can be loaded in the other end. The guide plate for the drills is spring mounted, and the correct location is assured by the guide pins that position it over each half of the fixture. The drilling machine is a Foote-Burt with a special head. Six holes are drilled in the heads for the 6-cylinder engine. The end is then finished grooved and faced.

In order to nest the cylinders close together, the heads of the 6-cylinder engine have half holes only on the adjacent sides. These half holes are secured by milling through the bolt holes on two sides with a pair of straddle saws, as in Fig. 3. The end heads are milled only on one side. The combination of saws and facing cutters mills the nut-bearing surfaces at the same time the sides of the flanges are cut off. The heads are located by the other bolt holes and held in position by the C-washers over the bolts shown in the center.

After the usual burring operations the heads are again water tested and undergo a final inspection on the bench shown in Fig. 4. Some of the heads are shown at *A* while at *B* is a gage that checks the bolt holes and the clearance of the sides. Snap gages of various kinds, for outside diameter and for the ring grooves are shown at *C*, while a "go" and "no go" contour gage is at *D*. The position of the lands for the ring grooves with relation to the head flange, is very important, and is gaged at *E*. The head is placed in the body of the gage with the flange resting on hardened pins, and seated firmly by the small taper key at the top. While in position, the two gages *H* and *I* are turned so that the wings sweep past the land to be gaged. One side of one gage checks the upper and the other side checks the lower side of the land. The two ends measure the high and low limits. The other gage checks the flange thickness. At the right, are the inspectors' stamps that pass or reject a piece. These stamps are mounted in a hammer head and make it easy to mark the casting.

One of the special features of the heads in the Knight

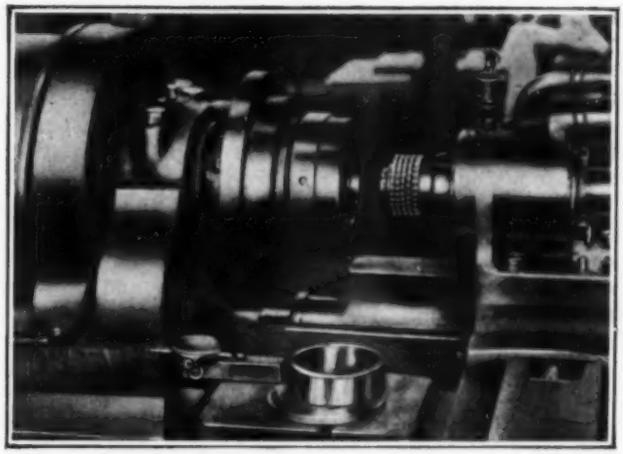


Fig. 8—Grooving rings on inside

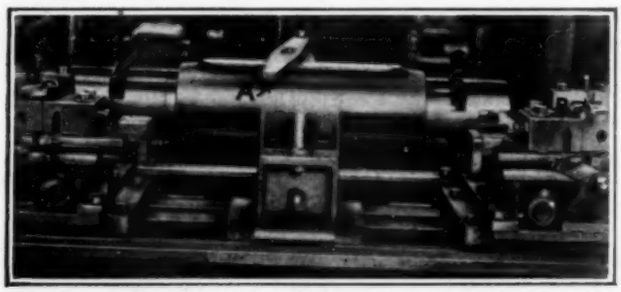


Fig. 7—Double-chucking device for turning outside diameter

Fig. 9—Inspection gages and methods

Automotive Production

engine is the use of packing rings. The lower ring is very broad, approximately an inch wide, and has an angular cut. It is practically five rings in one, since there are four grooves that leave five projections to fit into an equal number of grooves in the lower part of the head. The narrow ring above, is the same as a regular piston ring.

These rings are individually cast and the first operation is to bore four at once on a Baker drilling machine as in Fig. 5. The fixture is very simple, the four rings being simply pushed back in the opening and the cover closed over them. The threaded ring at the top is screwed down on the upper ring by the lever shown. It also centers the bushing that guides the bar on its way through the rings. After rough turning on a mandrel in an engine lathe, the rings are annealed and are then ready for the finishing operations.

Then the rings go to the device shown in Fig. 6 where they are knurled on the inside. The ring is somewhat larger than the knurl and is slipped over the end against the shoulder. The roll in front forces the ring in contact with the knurl, which produces a series of indentations inside the ring, giving much the same appearance and effect, as hammering the ring on the inside, to increase the tension.

The rings are slotted, rebored and ground on the inside, then go to the double-headed lathe in Fig. 7 for finish turning. This illustration shows the double-ended device for placing the rings on the mandrels in each head of the lathe. The whole machine is shown in Fig. 9 behind the inspection bench. The holder shown in Fig. 7 enables the operator to slip the ring into the open end which compresses it to size. By moving the lever *A*, the ring is placed over the mandrel and the open washer *B* is slipped over the end, through the slot *C*, when air chucks on the ends, Fig. 9, draw the ring solidly in place and hold it while being finish turned.

The final machining operation is to cut grooves between the five rows of indentation inside the ring. These grooves are cut by the milling cutters shown in Fig. 8 while the ring is compressed in the chuck on the lathe spindle. The chuck is simply a contracting chuck operated with a pin wrench. The lathe carriage, carrying the special milling head, is moved so as to bring the milling cutters in the right position. The position is very accurately gaged by means of the dial indicator which acts against a stop on the lathe bed. Lubricant is supplied to the milling cutters by a pipe. These wide rings fit similar grooves in the head, and close tolerances are necessary to secure a perfect seal, and at the same time prevent the slight metallic piston-ring "click" when the sleeve comes up over the ring. The methods shown, the close tolerances and the careful inspection, secure the desired accuracy and give the results required for quiet operation in service.

A few of the inspection gages are shown in Fig. 9. The ring thickness is gaged by pairs of pins as at *A* or *B*. The second gage is "go" and "no go," as is the width gage at *C*. At the left is a scale for weighing the pressure required to close the ring. The ring is placed in the holder at *D*, which is a thin steel band supported at each end. The lower end is fixed to the scale platform and the upper end to the scale frame. By means of the lever *E* the upper end of the band is forced down and the ring closed, while the scale indicates the pressure required to close the ring. The outside diameter of the rings is gaged by solid ring gages as at *H* and *I*.

The single ring used is the same as the regular piston rings and will be treated in a later article.

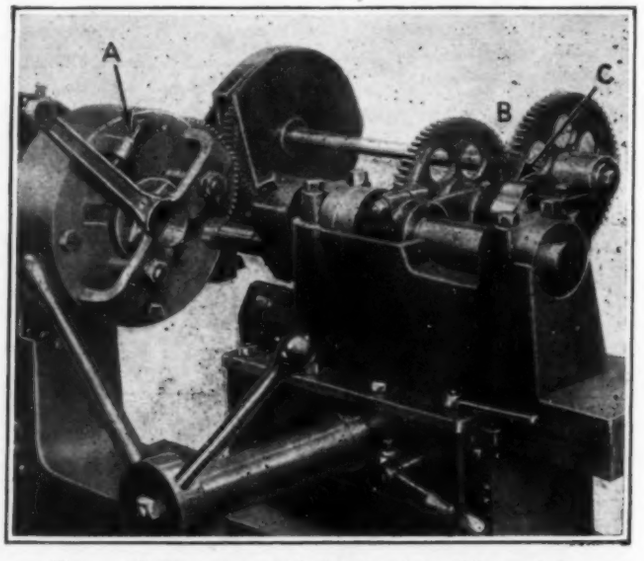
Boring an Oblong Hole

BY CHESTER H. FRANKLIN

In the majority of connecting rod work, the cap is cut from the rod before the hole is bored. Then the cap is bolted in place and both rod and cap bored together. In a few instances the hole is bored first and the amount cut out by the slitting saw is made up by a solid shim of the required thickness. In a few cases, the hole is bored oblong to a sufficient amount to allow for the saw cut. One method of doing this is shown herewith.

The machine used is a highly specialized adaptation of the Warner & Swasey, No. 4, plain-head turret lathe, to bore oblong holes. One cut only is taken.

The connecting rod is mounted in a special, air-operated fixture as shown, the rod being held by the two side clamps and the thrust taken by screw *A*.



Turret lathe arranged for boring oblong holes

The elliptical motion is imparted to the tool through a train of gears driven from the spindle, and shown at *B*. A special cam, *C*, mounted on what is usually the turret slide, gives a swinging motion to the head carrying the boring tool. This times the movement of the tool with the rod and allows the slide to be fed by hand.

The method shown represents the application of turret-lathe practice to a special problem. It is in line with the endeavor of many of the automotive engineers to avoid extremely expensive special machines, even when high production is wanted. The rods are bored at the rate of 120 per hour, floor-to-floor time.

Automotive Production

Abstracts

from other publications

Steel Requirements for the Automotive Industry

Steel requirements of the automotive industry far surpass anything previously known and they have contributed more than any single element to the building up of the great steel market for 1925. Not only were the gross needs of the automotive industry by far the largest in the history of that branch of manufacture, but what is more significant, they showed a faster rate of expansion than other consuming groups. This points to the way in which automotive transportation is increasingly drawing upon the ramified manufacturing capacity for production and maintenance. In 1925 this field, comprising the producing of automobiles, trucks, tractors and affiliated activities absorbed 14.58 per cent of the total output or approximately 4,675,000 tons of steel. This figure represents a notable increase in the tonnage of steel consumed by the automotive industry. The automotive field leads in the consumption of alloy steel.

The production of alloy steel exceeded one million tons, of which the automotive industry consumed 56 per cent, the machine tool industry 29 per cent and the railroads only 5 per cent. Chrome vanadium steel claimed the largest consumption, the annual output being 250,000 tons, the bulk of this being used by the automotive industry—*The Iron Age*, Jan. 7, pp. 11 and 15.

Repair Shop Cleanliness

A. E. Hutt points out that all men are more or less influenced by their surroundings and if mechanics are given dirty parts to work on they will not take as much care with their work as if they were clean. All vehicles coming in for general overhauling should have the parts thorougly cleaned with kerosene, gasoline or a solution prior to being worked on. Good housekeeping should be rigidily insisted upon in repair shops and a clean and tidy condition should be maintained. No junk of any kind should be allowed to accumulate and at night all tools should be put away in drawers or cabinets which have been provided for this purpose.—*Timken Magazine*, Nov., 1925, p. 539.

Heat-Treatment

A. H. Frauenthal and C. S. Morgan of the Chandler Motor Car Co. and the Automobile Machine Co., respectively, describe their heat-treating plants. The principal materials and products which are heat-treated are those which are used in rear axle, the transmission and the steering mechanism of the Chandler and Cleveland automobiles. The longest piece heat-treated is the rear axle drive shaft, approximately 30 in. long and 1⅛ in. in diam. All forgings received in this plant are annealed or normalized and are then shot-blasted and delivered to the machine shop, which is adjacent to the heat-treating department. After machining they are returned to the heat-treating department for heat-treatment. Parts which are carburized are assembled at the carburizing packing bench, and put into boxes. Parts which are hardened without previous carburization are distributed to the electric furnaces where they are mounted on jigs or fixtures suitably designed for supporting the pieces. In quenching these pieces at the proper heat, the entire fixture is likewise quenched. Incidentally, the carburizing boxes are of two types, one is of the circular chimney type and the other is of the rectangular type, both made of cast steel. The life of these boxes is between 1,000 and 1,200 hours, under ordinary conditions.

After tempering, the pieces are immersed in a hot caustic cleaning mixture consisting of 25 per cent caustic soda, 35 per cent trisodium phosphate, 35 per cent sodium carbonate and 5 per cent rosin.—*Transactions of the American Society for Steel Treating*, Dec., 1925, p. 851.

Arbor Presses

The arbor press is one of the undisputable pieces of equipment in the repair shop. On some presses about forty-five different operations can be performed, many of them being operations requiring less than 2,000 lb., while others are suitable for removing large gears and require more than 2,000 lb. pressure. Broaching of the big-end and small-end connecting rod bearings is considered by many as being the ideal method of finishing and these parts can be easily finished on the arbor press. Practically every engine manufacturer uses broaching to give the final size and the glass-like finish to the big-end connecting rods and recently repair shops have applied the method to finishing piston pin bearings not only where the pin rides in the end of connecting rod but also where the pin has its bearing in the piston bosses or in bushings pressed into these bosses.—*Automobile Trade Journal*, Dec. 1, p. 50.

Manufacturing Truck Bodies

Steel truck bodies fabricated by electric arc welding are 25 per cent stronger and cost one-third less to manufacture than do like products wherein the riveted method is used, according to R. E. Kinkead of the Lincoln Electric Co. The arc-welding process makes possible 100 per cent joints, virtually impossible by the riveted process. The average useful life of a welded joint in a truck body is twice that of the older riveted sort. A joint where the deposited metal is ground flush with the rolled steel will have a tensile strength of about 90 per cent; by making the cross section of the deposited metal somewhat in excess of the cross sections to be joined, a 100 per cent joint can be made. The metal deposited will have 45,000 lb. per sq.in. tensile strength and a shearing strength of 36,000 lb. per sq.in.—*Automotive Topics*, Dec. 26, p. 619.

Continuous Fractions as a Means for Figuring Change Gears—Discussion

By V. Charushin

AUTHORS who have written recently in the *American Machinist* on the subject of continuous fractions as a means for figuring feed gears have treated the common fractions, that could be used as approximations for the correct lead, as being of the same relative value. This I believe to be incorrect. From a practical standpoint most of them are not useful. In order to illustrate the point, I will take an example from my own recent practice.

We had to cut, very accurately a worm with a lead of 1.579 inches.

Converting this into continuous fractions we get:

$$1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{52}}}}}}} = \frac{1579}{1000} = 1.579$$

By dropping off the last common fractions one at a time starting with $\frac{1}{52}$ we will get the following:

$$\frac{30}{19} = 1.57895 \qquad \frac{8}{5} = 1.600$$

$$\frac{19}{12} = 1.58333 \qquad \frac{3}{2} = 1.500$$

$$\frac{11}{7} = 1.57143 \qquad 1+\frac{1}{1} = 2.000$$

It can be seen that all but the first approximation are useless except as a little exercise in arithmetic, and even the value of the first approximation $\left(\frac{30}{19}\right)$ is very doubtful when you have to figure change gears for the Gould & Eberhardt gear hobbing machine, when cutting a helical gear. But there is another way to get much closer values if the last denominator in the continuous fraction happens to be a fairly large figure, as is the case in my example.

Assume we give this last denominator values of 53, 54, and 55 to 57, in succession. We get the following convergent series with 1.579 as the upper limit:

$$\frac{1579}{1000} = 1.579000 \qquad \frac{1669}{1057} = 1.578997$$

$$\frac{1609}{1019} = 1.578999 \qquad \frac{1699}{1076} = 1.578996$$

$$\frac{1639}{1038} = 1.578998 \qquad \frac{1729}{1095} = 1.578995$$

The last numbers in the series can be used as sufficiently close approximation for any practical purpose. The other members of the series happen to be prime members. The series slowly diverge from the correct value at 1.579, downward.

I will now give the last denominator, of the original continuous fraction, the following values in succession 51, 50, 49, and 48 starting with the original 52.

The result will be another series with the correct value 1.579 as the lower limit of the series.

$$\frac{1579}{1000} = 1.579000 \qquad \frac{1489}{943} = 1.579003$$

$$\frac{1549}{981} = 1.579001 \qquad \frac{1459}{924} = 1.579004$$

$$\frac{1519}{962} = 1.579002$$

The members of this series are slowly increasing in value, thus diverging, more and more, from the initial value of 1579. The third number of the series $\left(\frac{1519}{962}\right)$ can be used as a close approximation.

Those members of either of these two series that stand away from the beginning, have very little practical value, especially when the last denominator of the original continuous fraction happens to be a small figure.

In this last case we get two rapidly diverging series and only very few members on either side of the correct figure will be of any practical value.

This is the point which was not mentioned in the various discussions and which I want to emphasize to the readers of *American Machinist* by example and word as it is of importance in solving practical problems.

Possible Unification of American and British Screw Thread Systems

The American Engineering Standards Committee and the National Screw Thread Commission have invited the British Engineering Standards Association to a conference to consider the possibility of unifying the American and British screw thread systems. The numbers of threads per inch for the various diameters correspond to a large extent for the two systems, since there are only two cases in which the British have a number of threads different from that adopted by the Americans for the same diameter, but a fundamental difference between the two systems exists with regard to the angle of the thread. This angle is 60 deg. for the American and 55 deg. for the British thread. The American thread also has flattened crests and roots, whereas those of the British Whitworth thread are rounded.

Invitations to the conference between the British and the Americans have also been issued to the Canadian and the Australian national standardizing bodies. It is understood that no final decision in the matter will be taken until after the problem has been considered in a general international conference to which all of the twenty national standardizing bodies will be invited.

There has been more progress in science and invention in the last twenty-five years than there was in the preceding twenty-five thousand.

The Problems and Functions of a Safety Engineer

By Kenneth C. Monroe
Safety Engineer, Bridgeport Brass Co.

Selection of proper safety devices—Co-operation of employees most necessary for establishment of safe practices — Safety bulletins and accident records

PRIOR to the passing of compensation laws, safety engineering was almost unheard of. In fact, industrial welfare work of any sort is still comparatively new.

Today, safety engineering is an important part of most manufacturing organizations. From an economic standpoint, it is often found that money spent on safety work brings a greater return on the investment than money spent directly on the manufacture of goods for sale. In addition to this, there is the satisfaction of knowing that safer working conditions will prevent unnecessary suffering and will, moreover, improve the morale of the entire organization to some extent.

ACCIDENT RECORD

DEPT. 297 MONTH OF March 1925

THIS DEPARTMENT HAD *NO LOST TIME ACCIDENTS*
IN March

HELP US KEEP UP THE GOOD RECORD

Safety and Sanitation Committee

Fig. 1—This form is used for a perfect accident record and is printed on blue paper

The problems of the safety engineer are many. His functions are to bring about safer conditions and his problems are to find ways and means of accomplishing this.

Insurance statisticians will tell us that the average employee can be exposed to a certain hazardous condition a definite number of times without getting hurt. An operator may work on a very dangerous machine for a very long time without even the slightest accident, and often the mistake is made of saying, "This machine is perfectly safe because we never had an accident on it." The human mind is not infallible, and in the performance of routine, monotonous operations, such as hand-feeding continuous-running crank presses, etc., the operator's thoughts are bound to wander away from his or her work. Modern piece-work and premium systems encourage taking chances. Taking chances without getting hurt encourages taking more chances. This explains the fact that many accidents occur to experienced operators.

When a bad accident takes place, everyone wants to suggest some way to "lock the barn after the horse is stolen," but when the safety engineer foresees a hazardous condition existing, he is apt to find that his greatest problem is to convince the department heads that he is not trying to spend all of the company's profits on unnecessary safety devices.

The safety engineer must first learn where safety devices are needed. He must then design such devices and see that they are installed in a manner not to interfere with production operations. He must use considerable discretion in laying out a program so that first consideration is given to the most dangerous conditions. This is particularly important if a limit is set on the amount of money to be spent on safety equipment.

It is very desirable that friendly relations be established among safety engineers employed by concerns engaged in the same, or a similar line of work. Hazardous conditions may often be eliminated before accidents take place when advantage is taken of the experiences of others. It is not at all uncommon for the safety engineers of competitive firms to get together periodically for the purpose of interchanging ideas on safety work.

Often it is necessary to make up experimental safety devices, in which case the safety engineer must be present when they are tried out to learn as much as possible from those who are to use the devices. He must periodically check up all safety equipment and make sure that it is serving its purpose. After he has done this he will find that his work is by no means done, for statistics will show him that more men are hurt every year by "stumbles and falls" and "handling heavy materials" than on "operating moving machinery."

Establishment of "safe practices" is the safety engineer's most important function. Here, he must start with the foreman, by pointing out to him that his department's accident record shows too many accidents classified as "carelessness" or "unpreventable by safety devices." Invariably, if the foreman is a "Safety

First" man, his department will show a better record on accidents.

Safety regulations must be installed and enforced by the foreman and his assistants. New employees must be properly instructed as to how to be careful. All employees must be educated to take an interest in safety work, to be proud of a good accident record, and to be ashamed of a poor record. Occasionally an employee is found who takes an antagonistic attitude toward safety work and refuses to adopt "safe practices"; laying off such a man usually has a very good effect on the rest of the workers in the organization.

The Bridgeport Brass Co. has made extensive use of safety bulletins furnished gratis by some of the insurance companies. Many of these bulletins are made from actual photographs which show clearly the results of carelessness. Bulletins are posted on bulletin boards, conspicuously located near time clocks and factory entrances. Not more than one or two safety bulletins are shown at a time on any one board and the bulletins are changed frequently. It is a great mistake to leave one safety bulletin up too long as the employees soon get out of the habit of looking at the boards as they pass them.

For statistical purposes, accident records should be kept by departments. Such records are of considerable value to the safety engineer, as they show where his services are most needed. Departmental accident records are posted monthly in each department of the plants of the Bridgeport Brass Co. Two forms are used for this purpose. Fig. 1 shows the form used for departments having no lost time accidents for the month. Fig. 2 shows the form used for departments having lost time due to accidents.

It will be noted that the form shown in Fig. 2 shows the mathematical derivation of the department's accident rating, "Days lost due to accidents *per 100 employees*." This is very essential when making comparisons between departments employing a different number of people. As a mark of distinction, form shown in Fig. 1 is printed on blue paper and form shown in Fig. 2 on red paper.

There are many other ways of carrying the message of safety to the employees, such as printing safety slogans on pay envelopes, etc. Care must be taken, however, not to overdo any one method to the extent that it becomes tiresome.

It is essential that the safety engineer personally investigate every lost time accident. By visiting the scene of the accident and talking with witnesses, first-hand information is obtained which is of considerable value in determining what action should be taken. The Bridgeport Brass Co. requires each foreman to report all lost time accidents to the safety engineer.

The hospitals of the Bridgeport Brass Co. come under the supervision of one nurse who makes out a daily report covering all treatments. A copy of this report is forwarded to the safety engineer with lost time accident cases marked with an asterisk. This serves as a check on the possible failure of any foreman to report an accident. The safety engineer analyzes the cause of each serious accident and writes a report describing the conditions and whatever methods he intends to use to prevent repetition of the accidents. Copies of these reports are forwarded to the heads of the divisions concerned and a complete file is kept for reference.

As a means of promoting safety work, the Bridgeport Brass Co. has a Safety and Sanitation Committee consisting of six representatives of each plant. The safety engineer is secretary of this committee. The committee makes a tour of inspection through the plants each month. Committee meetings are held monthly and recommendations offered are discussed and acted upon.

ACCIDENT RECORD

DEPT. 392 MONTH OF March 1925

Number of Lost Time Accidents this month	1
Days lost this month due to accidents	5
Number of employees in Department	121
Days lost due to accidents per 100 employees	4.14

NOTE:
"Days Lost" includes time lost this month due to accidents which occurred during previous months.

BE CAREFUL AND HELP US PREVENT ACCIDENTS
SAFETY AND SANITATION COMMITTEE

Fig. 2—This form is used for departments having lost time accidents and is printed on red paper

This article is not intended to be of technical nature. The problem of safeguarding the equipment of the Bridgeport Brass Co. is not unlike that of most manufacturing concerns. In the mills making raw materials, including brass rod, wire, sheet, tubing, and drawn shapes, there are the usual problems of handling heavy materials. The handling of these materials requires the use of many cranes, and every precaution must be taken to prevent the dropping of loads. In the divisions manufacturing brass articles, there are a large number of power press operations using standard equipment. Here, many safety devices are purchased and installed. The real problem is to determine what type of safety device is best adapted and to see that it is properly installed and used.

As no one knows just when an accident is going to take place, the safety engineer is seldom able to point out a specific case where he has prevented an accident, but if he maintains proper records over a period of time, the results of his activities will be clearly shown.

Industrial Swearing

It cost only $12.78 during the entire year of 1925 for "swearing" in the plant of the Darling Valve and Manufacturing Co. in Williamsport, Pa. Employees of the foundry and electrical departments made this donation to the Salvation Army for Christmas toys.

A year ago the foremen inaugurated a plan whereby every employee who swore, even as much as a casual "damn" had to place a sum of money in a little box. Dropping a tool, cutting a finger or any other little irritation that provided anything stronger than "gosh" was sure to bring a cuss levy. In the box when opened were several one-dollar bills "paid" for the larger and more strenuous of the cuss words.

Modern Tooling Methods for Turret Lathes

By M. E. Lange
Production Engineer, The Warner & Swasey Co.

Bar work and its problems—Types of machines available — Combined and multiple cuts — Methods for both small and quantity production—Layouts of tools

THE advantages of combined cuts from the square and hexagon turrets is evident. On work of short length, however, care must often be exercised to prevent tool interference between the tools on the square turret and those on the hexagon turret.

The taper stud shown in Fig. 11 is a short job, and in order to operate both turrets at once, the cutters are changed from their usual position in the square turret. They are mounted in the right-hand front corner, instead of the left-hand front corner, when in the cutting position, as indicated in Fig. 12. The bar is also drawn far enough away from the chuck to give the necessary clearance between the square turret and the automatic chuck. The two turrets can then operate without interfering, allowing both the hexagon- and square-turret tool stations to cut simultaneously.

> The first turret lathes, or screw machines, were used for making screws and small parts from wire, or rods. The modern turret lathe is a glorified screw machine adapted to larger and heavier work. By the same token, the tools it uses have been developed to a point little dreamed of in screw-machine days

This method applies to work of short length, unless the diameter of the bar is so small that the cutting off tool will dig and break. For example, a 1-in. bar of 0.10 carbon cold-rolled steel can be cut off with a ¼-in. wide cutter at a distance of 6½-in. from the chuck, even when the cutter is quite dull.

The first chucking of the taper stud is finished on a sliding-saddle type of turret lathe, equipped with a universal set of bar tools and a taper attachment. The illustration, Fig. 13, shows the tool equipment, while the layout in Fig. 14 gives the exact order of operations.

In selecting the machine for a given job, after the size required is decided, three questions usually arise:

1. Ram type or sliding-saddle type?

In the ram type of machine, the turret is mounted on a slide that moves back and forth in a saddle fixed at the proper point on the bed, as shown in Fig. 15 and 16. In the sliding-saddle type, as in Fig. 17, the turret is mounted directly on the sliding-saddle.

The ram type is generally used for light or simple work, because of its fast operation, while the sliding-saddle type is used for longer work, and in general, for heavier work.

2. Plain or universal carriage?

In the plain, cross-slide type of design, as shown in Fig. 15, the cross-slide is clamped in position and not moved under cut on the bed. The universal types, shown in Figs. 16 and 17, have a power longitudinal-movement for the cross-slide. This arrangement makes it possible to turn longitudinally under power, thus combining cuts on many types of work making it possible to locate cutters quickly and accurately for shoulder dimensions.

3. Cone pulley or all-geared drive?

The machine having a cone-pulley drive, shown in Fig. 15, gives two spindle speeds for each step of the cone. The all-geared-driven types with single-pulley drive, shown in Figs. 16 and 17, give 12 spindle-speeds directly. The latter type is therefore used for a greater and wider selection of speeds; for the convenient application for motor drives; and is in general more suitable for heavier and larger work because of its power.

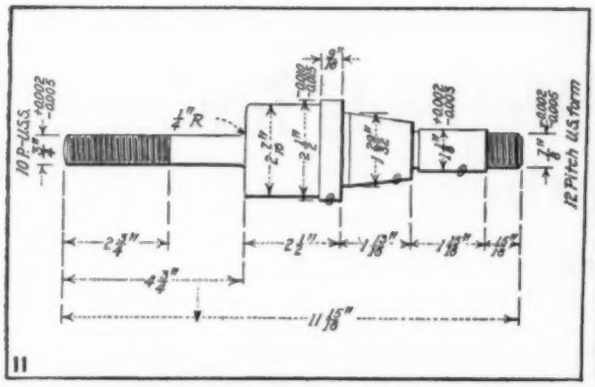
In laying out the operations, advantage should be taken of all the principles of combined cuts, multiple cuts and rigid tooling. In doing this, the nature of the work and the available tool equipment must be considered. Further, the quantity produced in the lot will determine, in many cases, what tool equipment will be most profitable for the job.

When close limits of + 0.000 — 0.001, with fine finish, are required from work turned from the square turret, two cuts are necessary, because there is no roller to burnish the surface. If the job is left oversize for grinding, one cut will be sufficient.

For accurate cuts from the hexagon turret, the diameter should be burnished to size by having the roller ride on the diameter. Then limits of + 0.000 — 0.001 can be held readily. If less accurate limits are allowable, then a multiple-cutter turner will reduce the time, letting the roller ride on one diameter only.

In laying out tools for making the feed screw shown in Fig. 18, from cold-rolled steel, a study of the drawing of the piece suggests turning part of diameter (2) while forming diameters (3) and (4). The job should, therefore, be put on an all-geared-head machine, as in Fig. 19, to obtain the power necessary for the combining of heavy cuts. The universal type of cross-slide is used to move the cutters along the bed to the several cutting positions.

The second article. The third will be published in an early issue.



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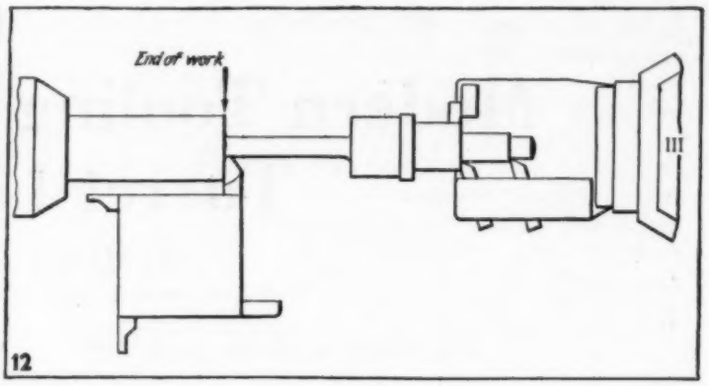

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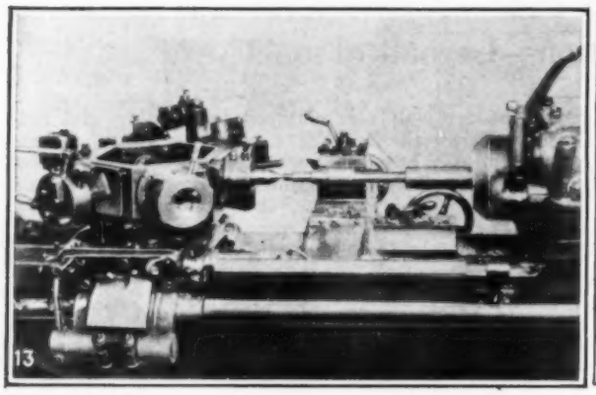
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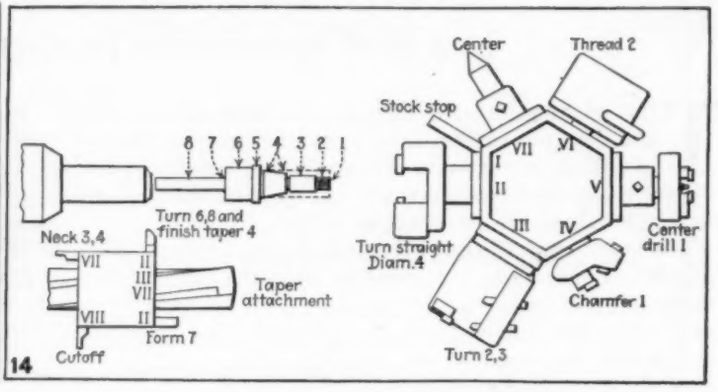

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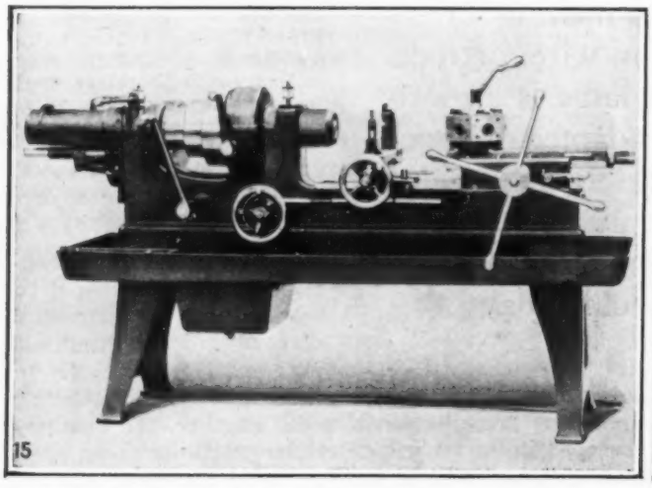
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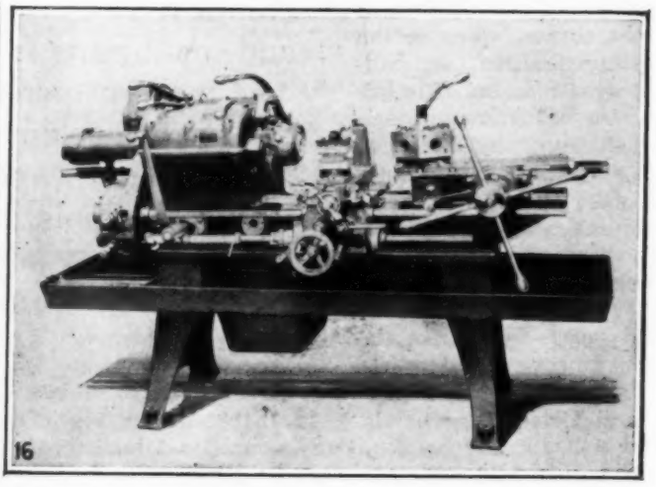
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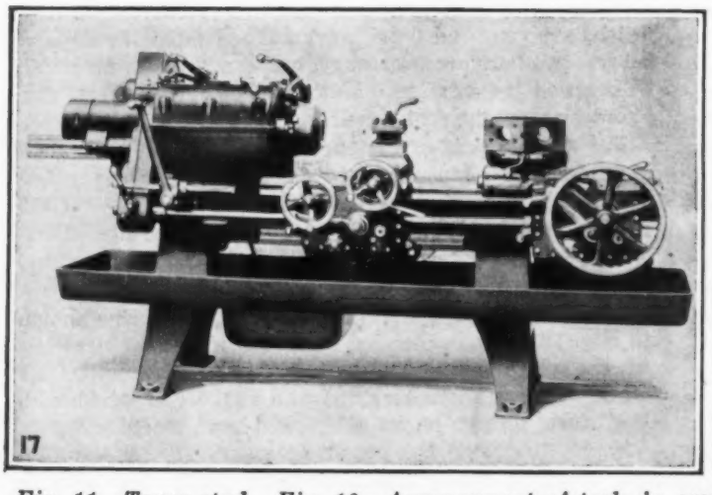
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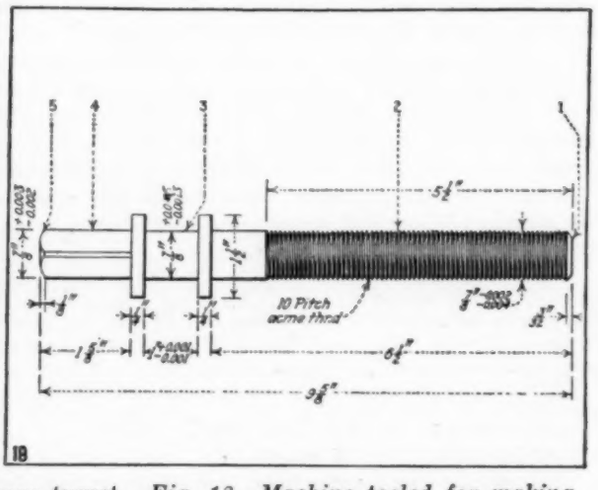

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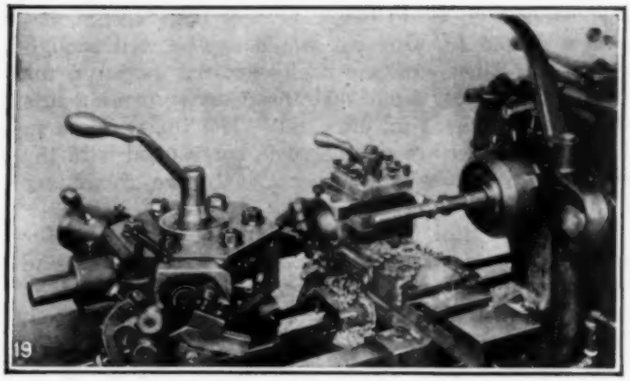
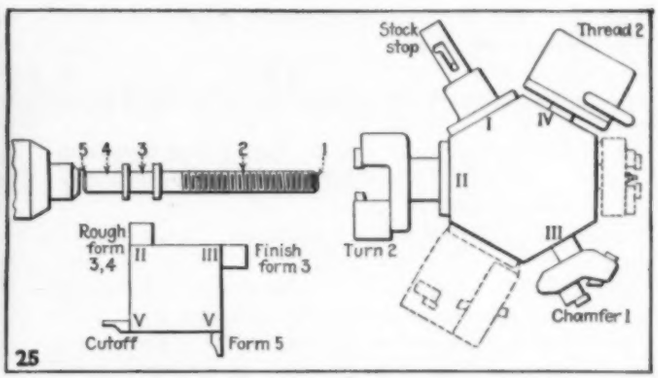
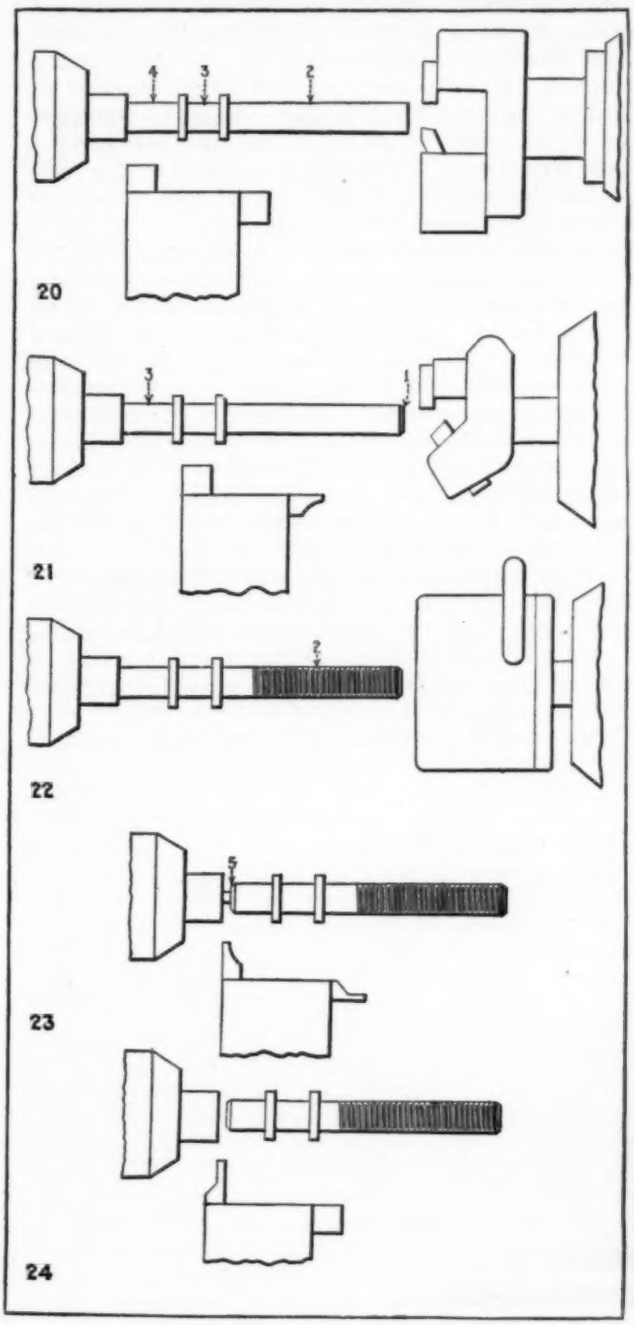
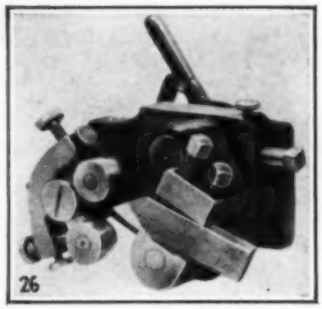
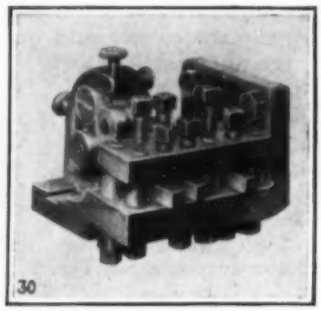
Fig. 11—Taper stud. Fig. 12—Arrangement of tools in square turret. Fig. 13—Machine tooled for making taper studs. Fig. 14—Complete tooling layout for making taper studs. Figs. 15, 16 and 17—Different types of turret lathes. Fig. 18—Typical cross-feed screw

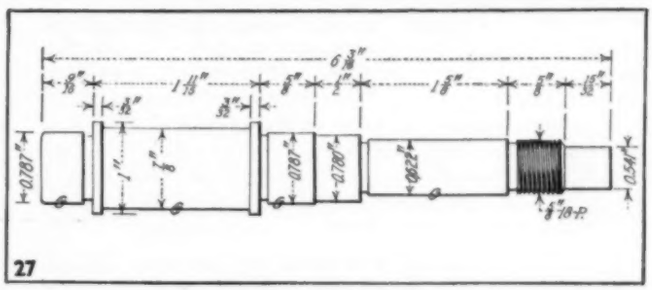


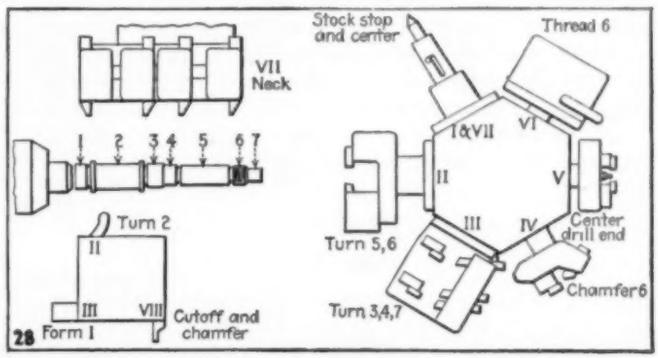












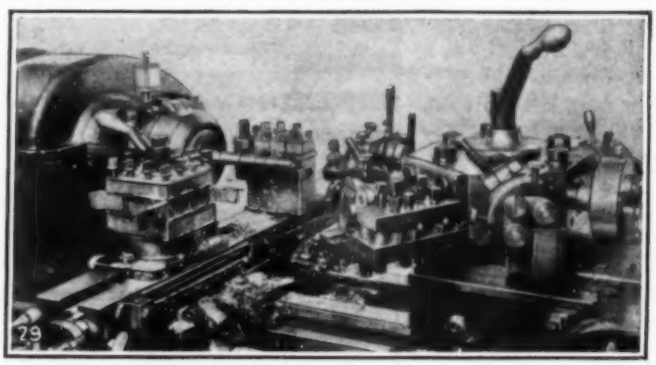


Fig. 19—Turret lathe tooled for making cross-feed screws. Figs. 10 to 24—Tools for successive operations in making cross-feed screws. Fig. 25—Tooling layout for making cross-feed screws. Fig. 26—A single-cutter turning tool. Fig. 30—A multiple-cutter turning tool. Fig. 27—An automobile fan shaft. Fig. 28—Tooling layout for making fan shafts. Fig. 29—Turret lathe tooled for making fan shafts

The next step is to write in proper order the list of the necessary operations:

I—Feed to stock stop.

II—Turn diameter (2), while forming diameters (3) and (4).

III—Chamfer end (1), while finish forming diameter (3).

IV—Thread diameter (2).

V and VI—Form-chamfer diameter (5) and then cut off.

Then the individual tools available are considered, and the exact tool layout is made. The sketches, Figs. 20 to 24, show the individual operations, omitting the simple, first operation. The complete tool layout in Fig. 25 shows the entire order of operations in condensed form, to designate clearly and quickly the exact tools used for the different jobs.

Second operation—

After feeding the bar to the stock stop in operation 1, turn diameter (2) with single-cutter turner on the hexagon turret as in Fig. 20, while forming diameters (3) and (4) with forming cutters held in the square turret.

Third operation—

Chamfer end (1) with chamfering tool held in haxagon turret, as in Fig. 21, wh.le finish forming diameter (3) from square turret.

Fourth operation—

Thread diameter (2) with automatic self-opening die head held in the hexagon turret, as shown in Fig. 22. A roughing and then a finishing threading cut are taken.

Fifth operation—

Form chamfer at head of diameter (5), as shown in Fig. 23, from square turret.

Sixth operation—

Cut off from square turret, as shown in Fig. 24, and chamfer stub for next piece.

The method described is suitable, for quantity production, where several lots of less than a hundred pieces each are made in a year. For small lot production, that is, making five to fifteen pieces at a time, diameters (3) and (4) would be necked and turned with standard cutters mounted in the square turret. Thus the expense of making the wide forming cutters would be eliminated.

On this job it would not be possible to push the bar out from the chuck to overcome tool interference, because a second forming cut would not be well enough supported. Since extreme limits are not required for this piece, it is possible to take these heavy forming cuts while turning the 1-in. diameter. The turret faces in the tooling layout are numbered to correspond with the order of operations and show clearly the combining of cuts.

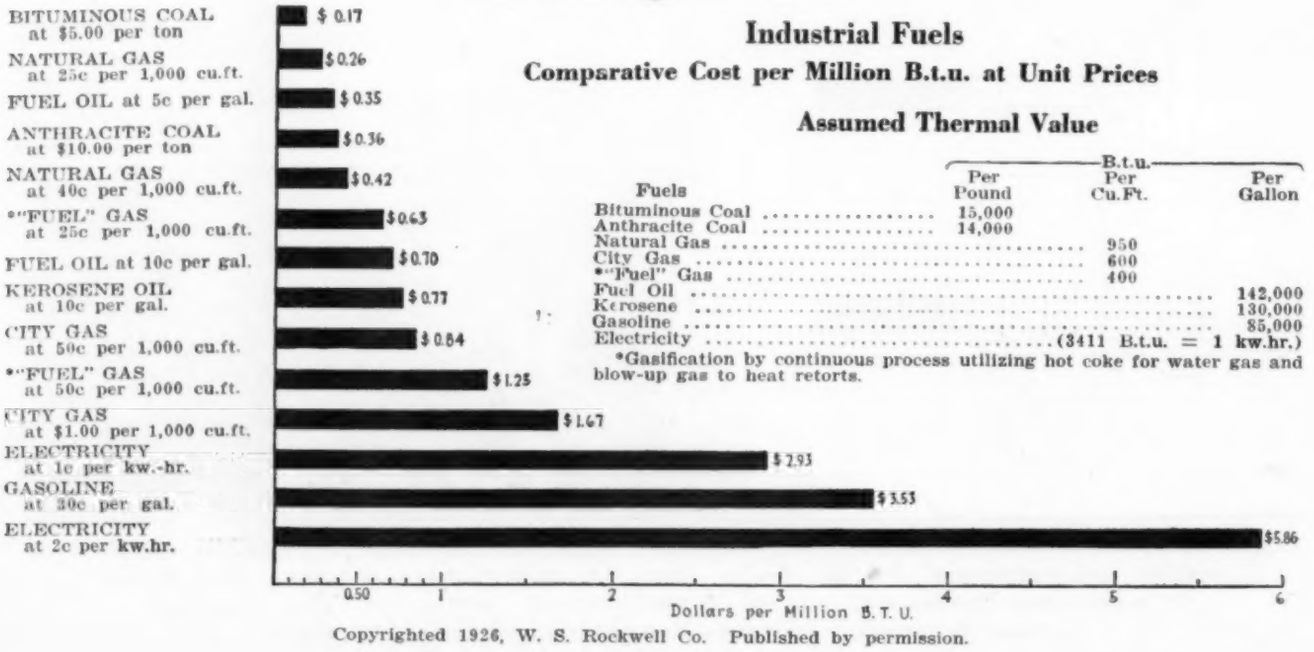
The single-cutter turner shown in Fig. 26 is used for reducing diameter. The roll acts as a steadyrest, and the cutter may be relieved when withdrawing the tool. This same tool will handle similar work ranging from $\frac{3}{8}$ to $1\frac{1}{2}$ in. in diameter.

The automobile fan-shaft shown in Fig. 27 is an example of bar working having several diameters and shoulder distances, produced in quantity lots. A study of the drawing suggests combined cuts for turning diameters (2) and (5). The tool layout is given in Fig. 28. The piece is put on a machine with a universal type of cross-slide, as shown in Fig. 29. The turning length of the shaft is short, allowing the use of a ram-type machine, and the size of the shaft requires a $1\frac{1}{2}$-in capacity turret lathe.

This piece is turned ready for grinding, so that the finish on the diameters does not need to be very smooth. A multiple-cutter turner, Fig. 30, with the rollers riding on diameters (3) and (5) is therefore used for turning diameters (3), (4) and (7), thus applying the principle of multiple cuts to the finish turning. Another application of the same principle, is the use of a standard necking block, mounted at the rear of the cross-slide, for taking the four necking cuts at one time. The necking is done while the shaft is supported by the center in the hexagon turret. This tool has provisions for the adjustment of the block for different jobs.

The tooling layout, Fig. 28, shows the turret faces numbered to correspond with the order of operations. For example, Cutter II, in the square turret, is turning at the same time tool II, in the hexagon turret, is turning. The tool for drilling the centers is equipped with three rollers that are closed on the work by a knob, for the purpose of supporting the end of the shaft.

(To be continued)



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Maintenance of Motive Power on New England Railroads

By Ellsworth Sheldon
New England Editor, *American Machinist*

Main and side rods for locomotives—The oxyacetylene profile cutting machine—Plain and ball brasses for rods—Devices to turn and bore spherical surfaces

THE locomotive blacksmith shop of the New Haven railroad at Readville, Mass., is fully equipped with large furnaces, heavy steam hammers, handling machinery, etc., to turn out the largest and heaviest forgings that are needed for locomotive repair, and except for driving axles and engine frames, practically all of the forgings for the locomotive shop are produced there. Smaller forgings that are required in large quantities are turned out at a rapid rate on the four forging machines.

A corner of the shop devoted to the manufacture of bolts, for which the demand is constant, is shown in Fig. 1, with one of the large forging machines and its furnace in the background. Any part within the capacity of the machines that is required in sufficient quantity to warrant the expense of tooling a machine is made here. Fig. 2 shows a small air-operated hammer, built in the shop, which the blacksmiths find very convenient for small and medium sized work where quick action is more to be desired than heavy blows.

Cutting by Torch

An important and valuable item in the equipment of the blacksmith shop is the Oxweld profile-cutting machine, in which the cutting tool is an oxyacetylene torch that is guided by a templet about the profile of the piece to be cut, and is actuated by a small electric motor. Many large pieces that were formerly the product of the forge, are now cut out of a billet by the gas torch in a small fraction of the time that would be required to forge them.

Then, too, there are certain kinds of work upon which neither the old-fashioned forge nor the modern cutting machine has advantage over the other, and in such cases one method is called upon to supplement the other. An example of this is shown in Fig. 3, in the shape of a side rod for a class I-4 locomotive.

A billet of alloy steel wide enough and thick enough to make the ends of the rod was the starting point, but the billet was very much shorter than is the finished rod. The mid-section was reduced in size and drawn out in length by the hammers, leaving to the machine the job of shaping the contours at the ends and cutting the round holes for the bearing bushings.

The templet by which the torch is guided in this operation may be seen on the pattern table of the machine. The forging to be shaped (in this picture it has already been shaped) lies before the machine upon trestles that are made principally of I-beams of structural iron. The beams are loosely placed so that they may be moved about easily, for it is necessary to have the part upon which the torch is at work overhang its support, because the flame would cut off the 12-in. beam even more readily than it cuts the forging.

The templet is made of strips of aluminum of about ⅛ by ⅛-in., bent to the required shape by any convenient means and fastened by riveting to a piece of ½-in. iron of the required width and length.

As the machine is not called upon to do any cutting upon the middle section of the rod shown in Fig. 3, the templet is made in two parts, joined together by a narrower strip of iron to which the ends are held by loose dowels. Thus one templet serves to cut all rods having the same end contour, regardless of the varying lengths between centers.

Other templets used to guide the torch in cutting circles—whether holes or outside contours—and large hexagon nuts, are shown in Fig. 4. The operator has only to place the templet on the pattern table, set the little tractor wheels on the desired contour, place a billet before the machine, light and adjust the torch and await results. Nuts are cut out of a 4-in. billet in about the time that would be required to take a working heat in the blacksmith's fire.

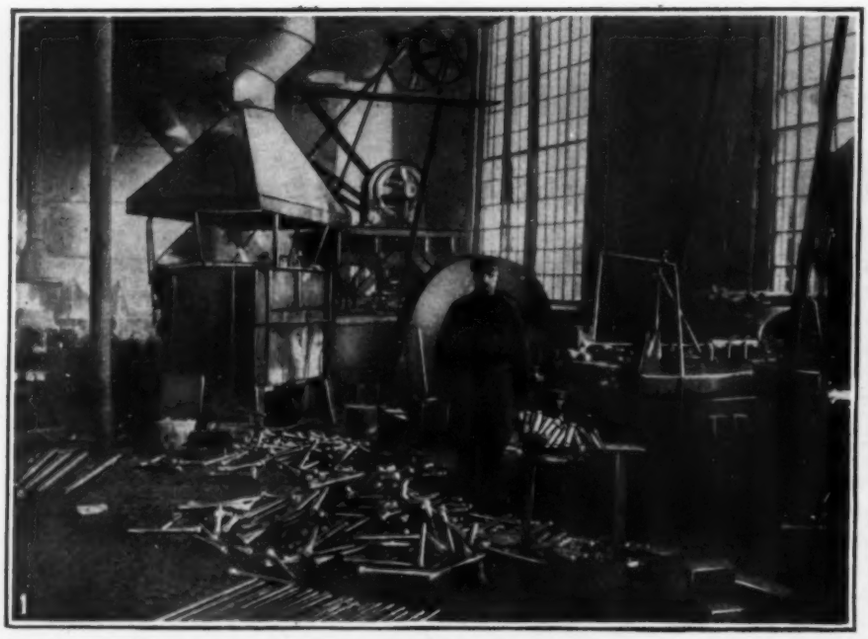
Saves Labor and Material

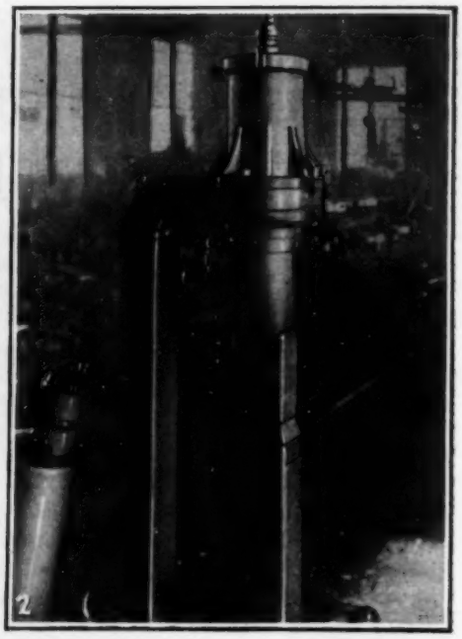
The long templet to be seen below the others in Fig. 4 is really two templets in one. At *A* and *B* are "switches" that may be turned to fill the gaps in either templet. By the use of this scheme a considerable saving is effected in backing material, the number of parts to be stored is lessened, and often a considerable portion of the contour of one templet coincides with that of the other, so that both labor and material is saved in the making.

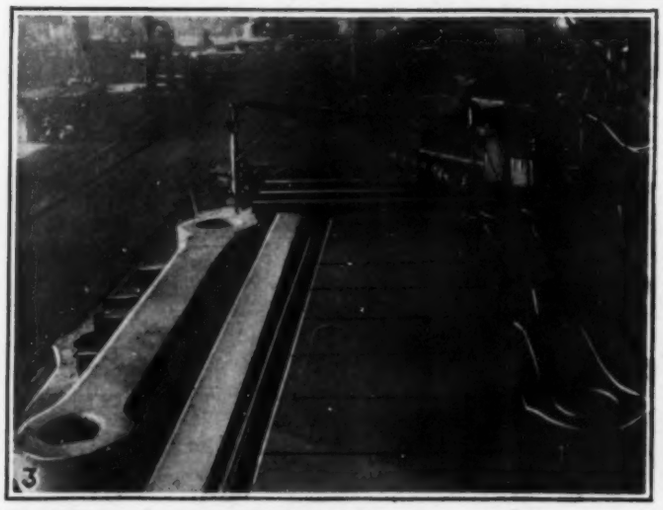
The switch idea serves another desirable purpose in the templets for the large nuts. It is expedient—though not absolutely necessary—to start a cut from outside the billet, or, in the case of an internal contour, from a drilled hole. By opening the switches *C* and *D* the tractor wheels of the cutting machine may be started on the displaced switch-section, and when they have travelled along to the fixed part, the switch is closed and the machine will then complete the circuit, having carried the torch into the billet from the outside.

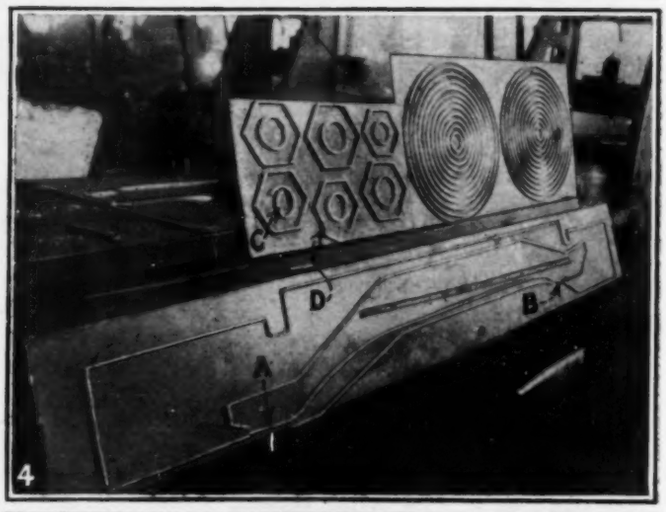
The job on the machine in Fig. 5 is the same rod that

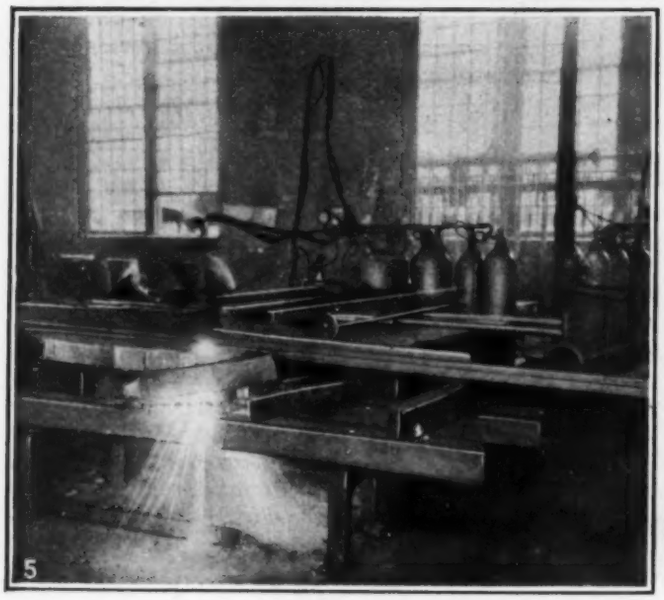
The third article. The fourth will be published in an early issue.











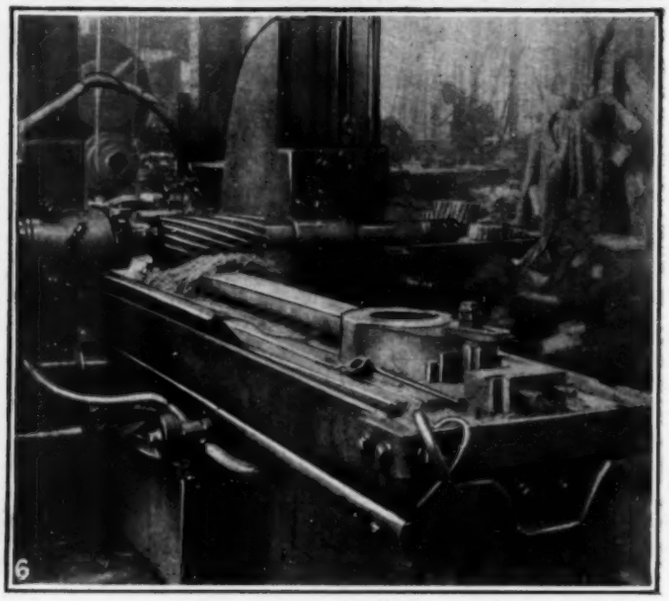
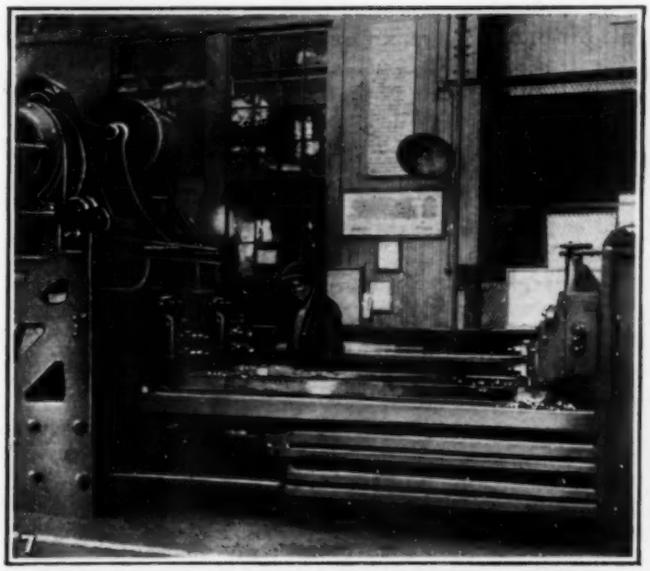
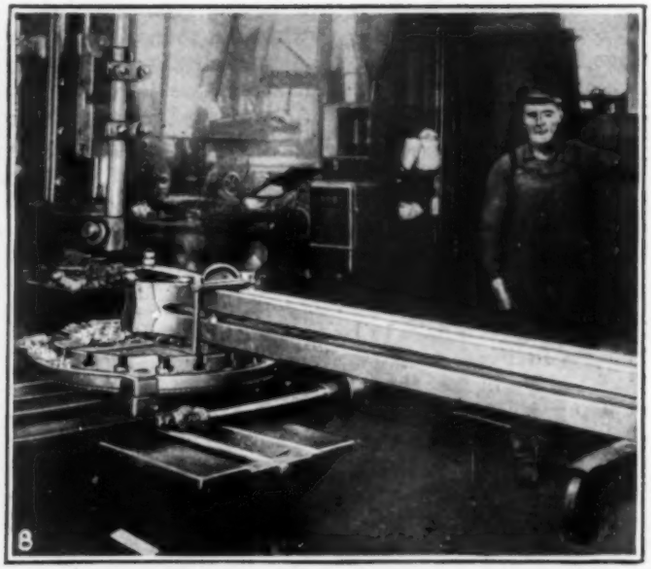
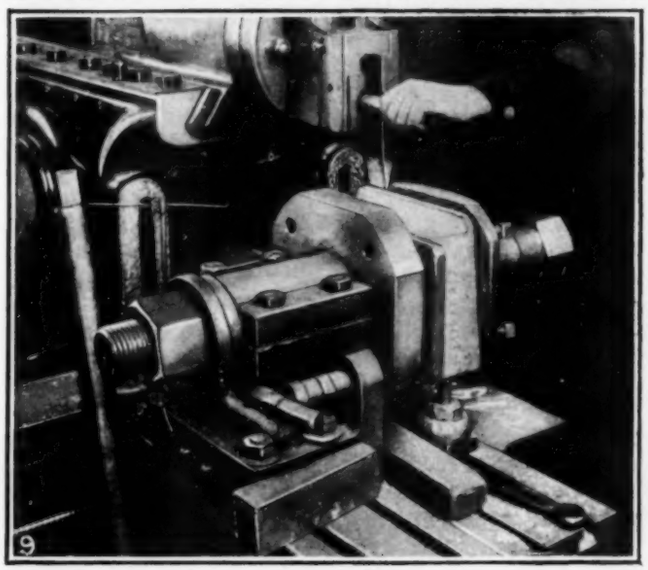
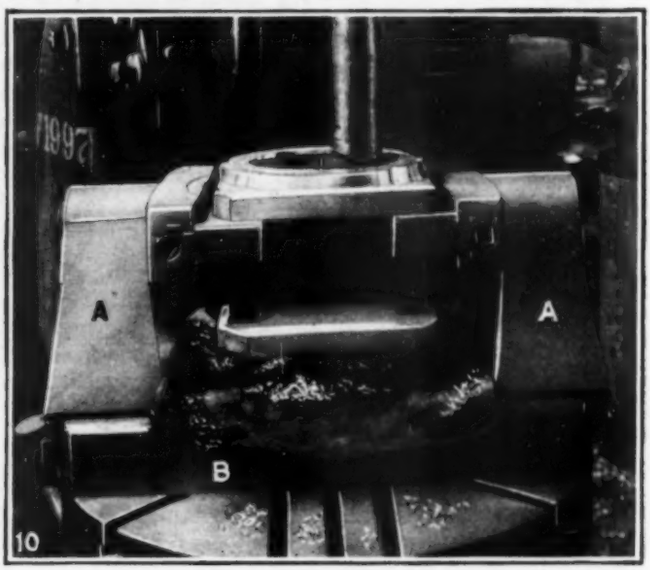


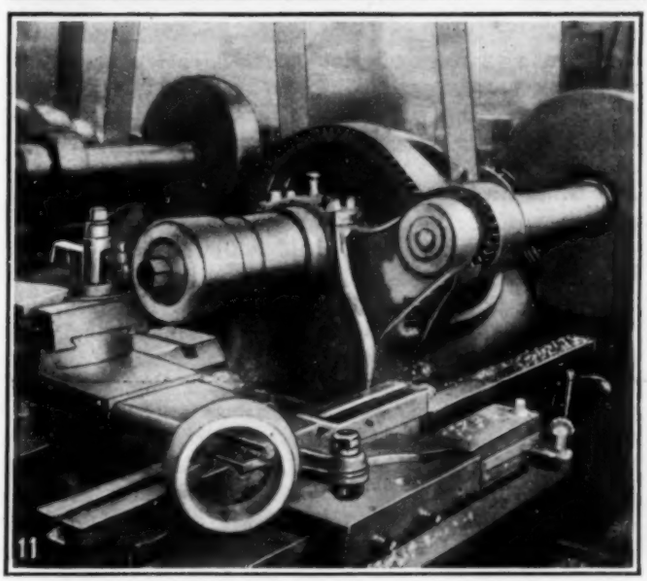
Fig. 1—A corner in the blacksmith shop. Fig. 2—A handy, air-operated hammer. Fig. 3—Large side rod on cutting machine. Fig. 4—Templets for the cutting machine. Fig. 5—The profile-cutting machine in action. Fig. 6—Side rod on milling machine, milling center section











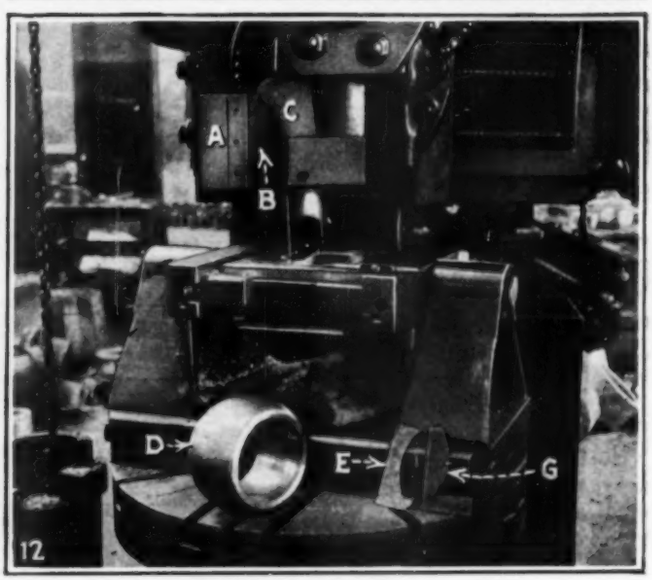


Fig. 7—Planing side rods on Woodward double-end planer. Fig. 8—Planing rod-end contours on slotter. Fig. 9—Fixture to hold rod-end brasses for planing. Fig. 10—A chuck to hold rod-end brasses on the boring mill. Fig. 11—Turning a ball bushing. Fig. 12—How ball brasses are bored

is shown in Fig. 3, the picture having been taken while the machine was actually cutting the round hole. The gas tanks may be seen behind the machine, and at the right is a portion of a similar machine in which the torch is swung from a pair of pantograph arms, and the flame is guided by a stylus that is traced by hand over a drawing. This type of machine is of advantage to produce single pieces, as it is not necessary to make a templet for it.

Though the gas torches of the cutting machines work very accurately to line, their product, so far as the vital parts of a locomotive are concerned, are still considered as forgings and have to be machined as such. The rods shown in Figs. 6 and 7 are of the same type, one of them being in fact the same rod as the one shown on the cutting machine. The rectangular mid-section is finished on a Becker planer-type milling machine, and the flat sides of the enlarged end portions are planed on a Woodward double-end planer having two sets of housings and cross-rails, so that it cuts both coming and going.

Because of a belief that the metal is injured to a greater or less depth by the action of the oxyacetylene flame, it is necessary to leave a certain allowance on the contours to be finished by machining, but the amount is far less on these heavy forgings than would be left by the most conscientious of blacksmiths. The contours of the rod-ends are planed on a slotting machine as in Fig. 8, about $\frac{1}{16}$ in. of metal being left for the operation.

Assures Accuracy

An indexing fixture, Fig. 9, is used on a crank shaper to hold rod-end brasses for planing them. This method of holding the work has an advantage over any manner of securing the brasses to the table of the machine by means of bolts and straps, for the reason that when the two parts of the brass are once clamped together in the fixture they do not have to be disturbed until the planing is completed, and their accuracy with respect to parallelism and squareness is assured by the locking bolt and index plate of the fixture. The final operation of fitting the brasses to their straps is still largely a job for the hand fitter.

A chuck to hold the rod-end brasses to bore the hole and face both sides in one set-up, is shown in Fig. 10 on the table of a vertical turret machine. The device consists of two, two-jawed chucks held in line with and facing each other, by spindles that may be rotated in bearings at the top of the brackets *AA*, which in turn are gibbed to slide lengthwise on the base *B*, under control of a large right-and-left-hand screw. The ends of the large screw are squared for a wrench, or crank-handle. Radial keys of substantial proportions, integral with the backs of the chuck bodies, engage corresponding keyways, in the faces of the brackets.

When the work, which in this case is in two pieces, is clamped by the chuck jaws, and the brackets are forced together as far as the work will permit by turning the large screw in the base, the work is held rigidly in the position here shown, in which position the hole is bored and one side faced. To turn it over for facing the other side, the brackets are withdrawn far enough to disengage the radial keys, when the chucks and work may be turned the other side up—without disturbing the work in the chuck—and again clamped by advancing the brackets.

On some locomotives, notably the Santa Fe type, it seems to be necessary, or at least desirable, to provide a sort of floating connection between the front end of the side rod and the crankpin of the forward driving wheel. The result desired is attained by placing on the crankpin a bushing, made of steel, the outer surface of which is turned to a spherical contour. This bushing is enclosed by a two-part brass having the bearing surface bored spherically to match the bushing.

In Figs. 11 and 12 are shown, respectively, the methods employed to machine the bushing and the brasses. The bushing, having been bored and faced on both sides, is placed in a small lathe having a taper attachment, where it is held for turning by an expanding mandrel. The taper attachment, however, has nothing to do with the job except to provide a place to which to fasten a member of the profile turning device.

Held by Stud and Roller

The regular slide of the taper bar is replaced by a larger one that is fitted with a taper gib to lock it firmly in place on the taper-bar, and in its upper surface a semicircular groove, or slot, is milled. Instead of the bolt by which the lower member of the double cross-slide of the lathe carriage is usually fastened to the taper-slide, there is a stud with a roller to fit in the formed groove.

It will readily be seen that with the slide locked to the taper-bar and the longitudinal feed of the lathe engaged, the point of a tool in the toolpost will follow a curved path, the radius of which is the mean radius of the semicircular groove. The bushing is reduced to approximately a spherical shape by manipulating the sliderest of the lathe by hand before engaging the device, which is thus called upon to do only the finishing cuts.

The same chuck that is shown in Fig. 10 is used to hold the "ball-brasses" for boring and facing them. The attachment to produce the spherical bearing surfaces may be seen in Fig. 12, where at *A* is a holder attached to the saddle of the machine, to carry a semicircular disk *B* of hardened steel. The boring tool consists of a shank to fit the turret of the machine, having at its lower end an enlarged boss that is slotted to receive the tool carrier *C*.

The latter member is pivoted near its center and carries at its lower end a toolbit that is held in place by suitable setscrews, while at the upper end is a roller to bear upon the semicircular disk before mentioned. As all parts are attached to the saddle of the machine and move with it, the tool point may be adjusted radially to make successive cuts by merely turning the crosscrew of the machine.

The semicircular disk is held in its holder by headless setscrews so that its position may be adjusted vertically with relation to the roller, so as to bring the point of largest diameter of the bore midway of the brasses.

As the tool-slide of the machine moves downward, the point of the tool is caused to describe an arc, the radius of which is the radius of the semicircular disk, plus the radius of the roller. At *D*, *E*, and *G* in Fig. 12 may be seen a "ball-bushing," and the external and internal contour gages.

Standardization does not mean deadly uniformity in houses or clothes. Will a city be any less beautiful if all its sewer pipes in a given district are of one size instead of having a dozen sizes?

Book Reviews

The Bureau of Standards. Its History, Activities and Organization. Service Monograph No. 35 of the United States Government. By Gustavus A. Weber. Three hundred sixteen pages, 5½x8½ in., cloth covers. Published by The Johns Hopkins Press, Baltimore, Md., for the Institute for Government Research. Price $2.

The Institute for Government Research has undertaken the preparation of a series of monographs, uniform in style and arrangement, which give detailed descriptions of each of the fifty or more distinct services of the government. This book is the thirty-fifth of the series. It is wholly descriptive in character and no attempt at criticism or suggestions as to possible improvements in the administration of the Bureau of Standards have been made.

A glance at the eleven pages of bibliography and a study of the text indicate the thoroughness with which the book was prepared. It is a most complete reference work. In the appendix one may find the exact number of people employed in each department and, omitting actual names, the salary that each receives. There is also cataloged in the appendix a list of all the laws relating to standards and to the Bureau of Standards that have been enacted.

The first seventy-five pages are devoted to history. Congress was given the power "to fix the Standards of Weights and Measures" in the Constitution of the United States, and this section tells of the various plans that were subsequently proposed to fix standards, many of which were never adopted, and the legislative action that followed these attempts. The interdependence of our standards upon those of European countries is made quite evident. The remarkable expansion of the Bureau of Standards in the twenty-five years since it was first created by law (March 3, 1901) is also made apparent in this and in other parts of the book. One outstanding characteristic of this history section and other sections of the book is the lack (no doubt deliberate) of the personal touch. Facts are related in a cold, impersonal way and this lack of warmth makes the reading somewhat dry. History is built around real, live people, but here only a few names are mentioned in the entire volume; Dr. S. W. Stratton, director for 23 years, is only mentioned once, for instance.

In the section on activities we find that the Bureau is today a veritable university of scientific knowledge. Researches are being carried on in not only weights and measures, but also electrical work, gas engineering, safety engineering, radioactivity, x-rays, heat and power, building materials, automotive products, optics, chemistry, mechanics, sound, metallurgy, ceramics, glass and so on, to mention only the general heads.

The chief value of such a work as this is to prevent duplication of effort by government bodies through ignorance of what each branch is doing. It will also acquaint members of Congress with the service for which they are called upon to legislate money, and will allow the public to bring an enlightened opinion upon the conduct of this phase of government affairs. To the industrialist this booklet points out the facilities with which the Bureau of Standards is equipped to solve his general problems.

Budgeting to the Business Cycle. By Joseph H. Barber, staff assistant to the president and head of the planning and statistics section, the Walworth Manufacturing Co. One hundred and eight pages, 5x7 in., cloth covers. Thirty-four illustrations. Published as No. 38 of the "Ronograph Library" by the Ronald Press Co., 15 E. 26th St., New York City. Price $1.25.

An unusual book, in that it provides an actual "case" out of experience, including many concrete examples, with tables and charts based upon actual data of the Walworth business. Its value is the more pronounced because of the lack of literature on budgeting to meet the business cycle.

The author's divisions of the subject are "Prime Difficulty in Budgeting Control; Problem of Harmonizing Budget and Trends; Cycle Analysis of a Particular Business; Comparative Predictions from Underlying Trends; Quantitative Predictions of an Industry's Trend."

A fair indication of the aim and the contents of the book is contained in this extract from the preface: " . . . there is found in this volume a record of developed practices that were evolved to meet real needs and that have been submitted continuously to the scrutiny of 'Actual vs. Estimate' comparisons. The methods have worked in practice. Their results have been procured economically. Indeed, forecasting has helped to earn the profits of the business because it has helped to meet and solve some of the most perplexing problems of the business."

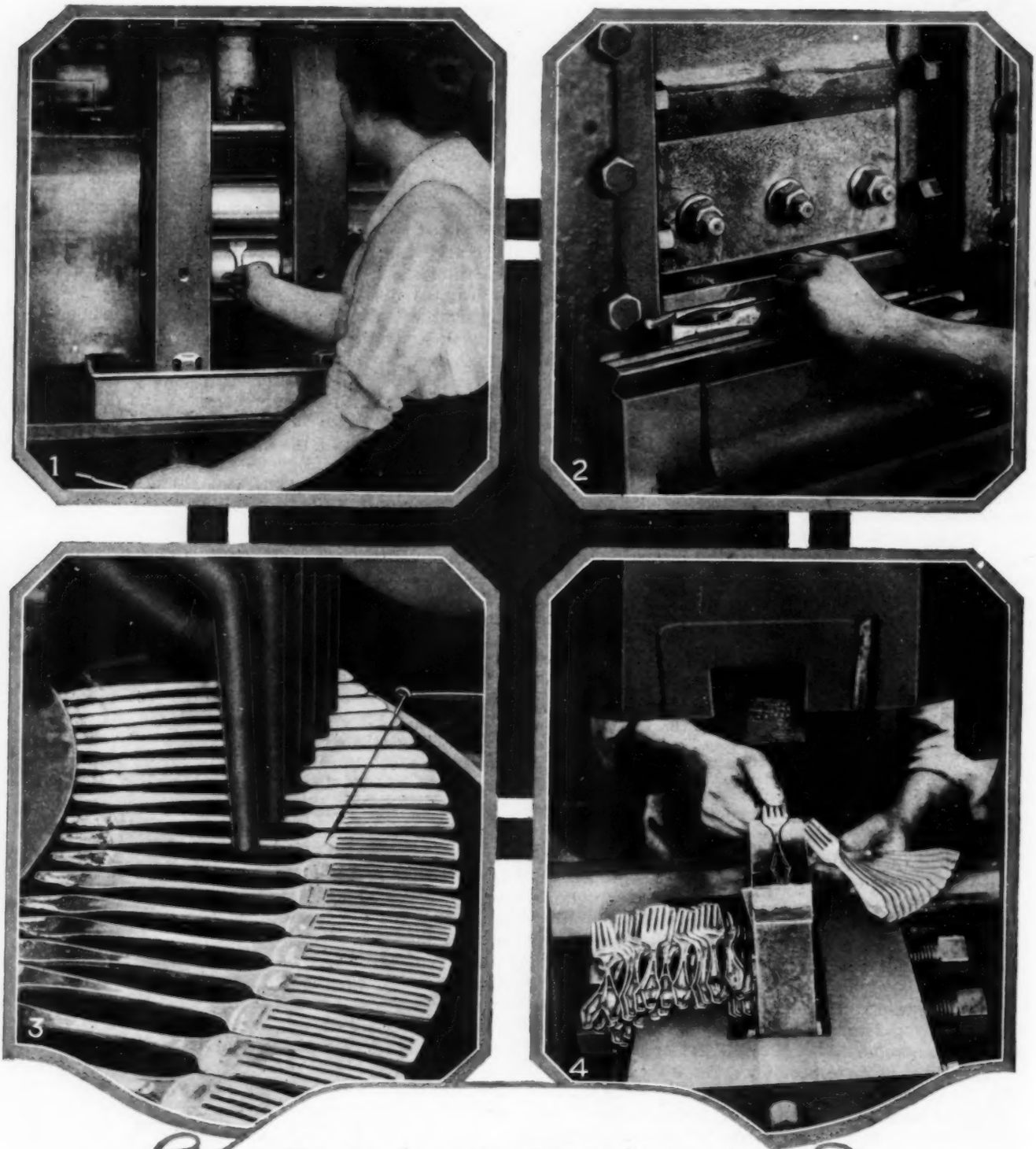
Automobile Worm Gearing. By the Technical Staff of David Brown & Sons, Ltd. A paper-bound booklet of four sections and ninety-six pages. Illustrated. Published by David Brown & Sons (Hudd.), Ltd., Lockwood, Huddersfield, England.

Although this booklet is largely concerned with the patented DBS system of worms, it is by no means a catalog or piece of advertising literature in the ordinary sense; it is rather a well prepared and well written text-book on the subject. No press agent style is evident and instead we find only sober engineering facts or opinions.

The book is divided into four sections: namely, the final transmission, the DBS patent worm gear, worm gear design, and the application of DBS worm gear. The first section states the case of the worm against the spiral bevel gear as the final drive of an automobile and then proceeds to demonstrate the advantages of the straight worm over the hollow, or Hindley, type from the point of view of theory and manufacture.

The second section explains in detail the DBS system of worm gear. Theoretical considerations are discussed and then the reader is given an intimate glimpse into the manufacture of these units. The third section on worm gear design uses a new system of notation, which is applicable to gears of every kind and which is based upon the module pitch (the inverse of diametrical pitch). Basic formulas on worm design are given and other calculations such as bearing loads, shaft stresses, and worm temperatures are explained.

The last section deals with the application of worms to automobiles. Photographs and line drawings are employed to amplify the text. English practice is evident from the complete absense of radio-thrust ball bearings and the presence of single or double direction ball thrust bearings in all rear axles.



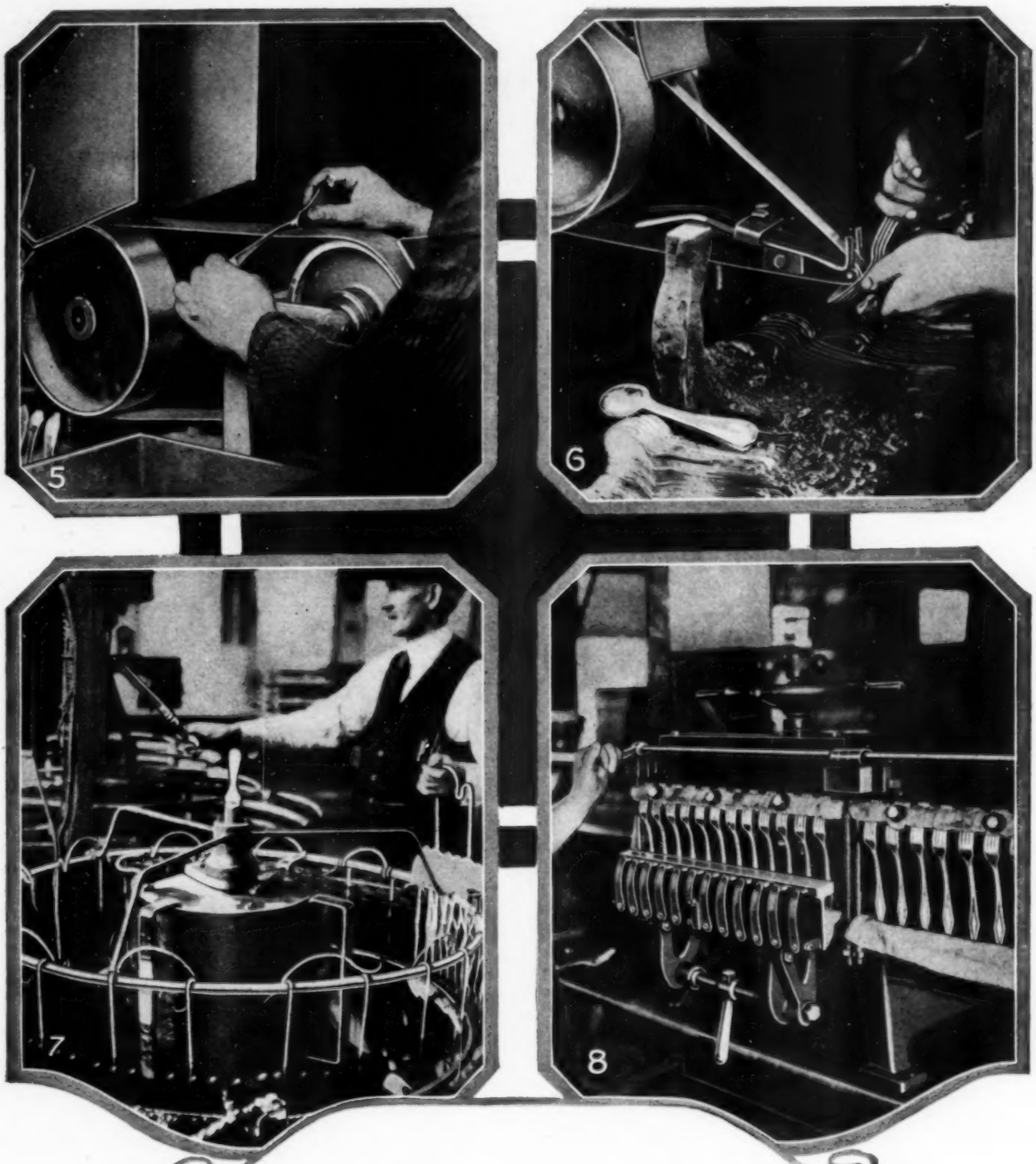
Steps in the Making of Inlaid Plated Silver

1—Rolling blank for length and thickness

2—Blanking a spoon to shape

3—Fusing the silver inlays in place

4—Striking the pattern into the blank



5—Smoothing the edges
6—Polishing before plating
7—The plating tank
8—How forks are burnished

Photographs by courtesy of the
Holmes & Edwards Silver Co., Bridgeport, Conn.

Ideas from Practical Men

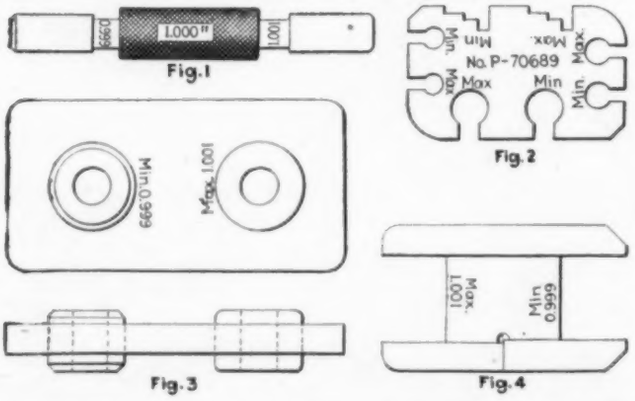
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Method of Indicating Go and Not Go Ends of Gages

BY F. W. BACH

In a shop where the writer worked, the gaging system, wherever a snap gage could be used, was so simple that much time was saved in the gaging, since the one doing the gaging could tell at a glance without seeing the figures, which was go or not go end, as the following examples will indicate: A double end plug gage for a 1-in. hole is shown in Fig. 1. The small or go end is chamfered at an angle of 45 deg., and the not go end has the corners rounded to ¼-in. radius.

The snap gage shown in Fig. 2 is for a screw and has complete gaging slots for the work, including the maximum and minimum for total length, and maximum



Figs. 1 to 4—Gages with rounded corners at maximum ends and chamfered corners at minimum ends

and minimum length for the shoulders, the rounded corners indicate the maximum openings of the gage, while the chamfered corners indicate the minimum openings.

The double ring gage shown in Fig. 3 is made on the same principle, the outside corners of the maximum ring are rounded, while those of the minimum ring are chamfered. In Fig. 4 is a built-up snap gage embodying the same idea.

Calculating Lead Gears—Discussion

BY CHARLES KUGLER

The article by H. H. Welander, under the title given above and published on page 1019, Vol. 63, of the *American Machinist*, interested me very much. With such a table of decimal equivalents of fractions at hand the task is greatly shortened.

There is a slight error in this article of subtracting fractions. It should have been thus:

		36	83
		23	53
	2	13	30
		6.5	15.0

Further, Mr. Welander says that, if greater accuracy is required, the difference can be divided by 3 or 4, instead of 2, and the result added as before. Note how this works out when 3 is the divisor.

	36	83	23	52
	23	53	4.3	10
3	13	30	27.3	63
	4.3	10		
			273	630 call

The fraction $\frac{273}{630}$ equals 0.433333, which is further from 0.433841, the desired ratio, than the result obtained with 2 as a divisor. Dividing by 4 gives us 0.433057, which is the worst of the three figures. Hence there must be some error.

Where there is such a table available as decimal equivalent of fractions, and it is required to find fractions between any two given fractions the following rule is one that I have been using for many years. I have never seen it in print anywhere. It is as follows: If we add the numerator and denominator of two fractions, the result will be a fraction between these two fractions. This affords a simple rule to follow.

Just how this works out in the case under discussion you can see for yourself. Thus:

$$\frac{23 + 36}{53 + 83} = \frac{59}{136} = 0.433823$$

Thus simple addition gives the same result as obtained by Mr. Welander. If more accurate results are desired, proceed as follows:

$$\frac{23 + 59}{53 + 136} = \frac{82}{189} = 0.433861 \quad \text{(high)}$$

$$\frac{59 + 82}{136 + 189} = \frac{141}{325} = 0.433846 \quad \text{(high)}$$

$$\frac{141 + 59}{325 + 136} = \frac{200}{461} = 0.433837 \quad \text{(low)}$$

$$\frac{200 + 141}{461 + 325} = \frac{341}{786} = 0.433842 \quad \text{(high)}$$

$$\frac{200 + 341}{461 + 786} = \frac{541}{1247} = 0.433841 \quad \text{the desired ratio.}$$

This method always gives a fraction between the two fractions.

Making Multiple Patterns in White Metal

By Donald A. Hampson

The case here cited is a good example of what may be done to reduce pattern costs on production work, by the use of white metal castings instead of wood. Three thousand castings were required of the form shown in Fig. 1. There were to be two sizes, all four inches long. Half of them were to be 1½ in. in width and the other half to be ¼ in. wider. So far as the foundry work was concerned, it was an easy job for a power squeezer, and the preparation was very simple; merely screwing the flat-back patterns to a stock board for a 12x18-in. flask. But to make six patterns of each in wood, and expect them to be of such quality as would stand making 150 molds a day—retaining their accurate size and shape—and being good for future orders if received, was quite another matter. It happened that the superintendent of the plant had been waiting for just such an opportunity to demonstrate the lower costs, greater durability, and quicker delivery of white-metal patterns cast in metal molds, over those of wood, and he seized the opportunity to prove his idea upon a shape coming within that range.

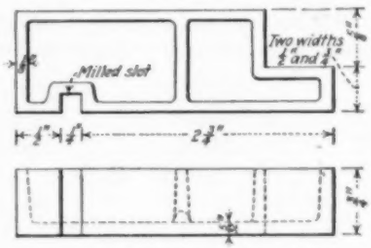


Fig. 1—The casting to be made

Using a cast-iron plate 8-in. square, as a back, four pieces of ¾-in. cold-drawn steel were screwed to it to form the outside of each of the patterns, as shown in Fig. 2. A block set in one side formed the recessed corner. Two sets of holes were made for one of the side pieces, to allow it to serve for both the required widths. Thus the outside form was completely taken care of.

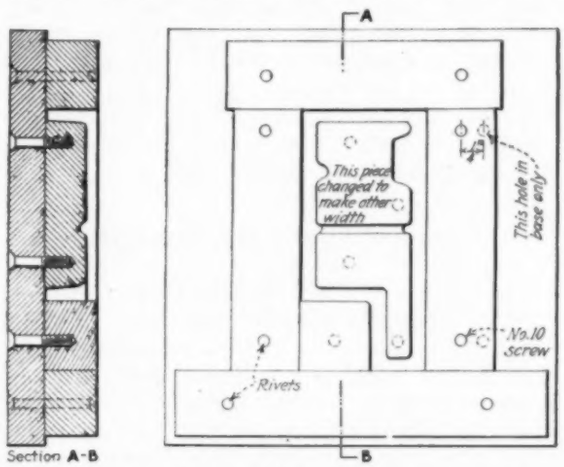


Fig. 2—The mold in which the patterns were cast

To secure the cored inside, with its ribs and bosses, blocks, properly notched, were screwed within the rectangle made by the pieces already attached to the plate. Simple cuts on the miller produced the outline for these cores, and the fillets were taken care of by rounding the corners with a file. The difference in width came in the side of the casting that has the extended end, and so two separate blocks were made for this side. The other side of the pattern was the same for both castings and was left undisturbed throughout the world.

Old babbitt metal that was around the plant was used in these patterns, it being largely composed of No. 4 metal and trolley-motor bearings. Before pouring, the mold was warmed and smoked with a torch. As soon as the pattern castings solidified, they were dumped out, taking with them the part of the core forming the tail piece, which had been unscrewed. It was then pulled out of the casting and returned to the mold.

The patterns were cast $\frac{1}{16}$ in. higher than wanted, so that the tops could be machined, taking out any sink spots and bringing them to the given height from the rim edge. Otherwise, a little dressing with a file to remove traces of fins was all the finishing necessary. Made in this way, the patterns did not vary over 0.02 in. from each other and there was no danger of their warping or falling apart from rough usage. They were delivered in half the time it would have taken to get out wood patterns, and the cost showed a proportionate saving.

Fixture for Grinding Internal Radii

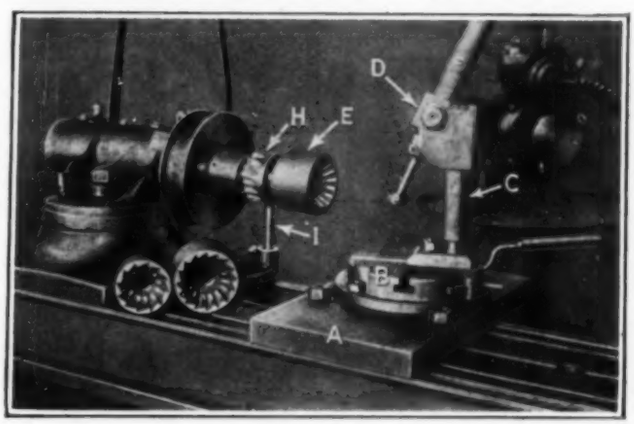
By Dayton Wright

The spherical tools for refacing the joints on superheater-pipe units are almost impossible to grind without the use of a special fixture in connection with the grinding machine.

Our tools of this kind are small, ranging from 2⅛ to 2¾ in. in diameter, and the fixture shown was designed for grinding them. The plate *A* was fitted to the slots in the grinder table and mounted thereon is the turntable *B*, having two T-slots at a right angle with each other. The turntable is guided by a central pin and is clamped by bolts that travel in a circular T-slot in the base *A*. Mounted on the turntable is the column *C*, provided with a head in which the block *D* is arranged to swivel in a vertical plane and to be clamped in any position to which it may be set. The block *D* is bored to take the handle of a Strand flexible grinder.

The tool to be ground is shown at *E*, threaded on a taper shank that fits the spindle of the machine. Back of the tool is the notched collar *H* which has the same number of notches as there are teeth in the tool. Indexing is done by revolving the spindle until the side of one of the notches in collar *H* contacts with the finger *I*.

By properly adjusting column *C*, off center, and adjusting the grinder so the wheel spindle will clear the



Device for grinding internal radii

work, it will readily be seen that revolving the turntable will cause the wheel to describe an arc of any radius desired, within the limits of the device. The wheel should be dressed to a shape that will give the proper clearance angle to the teeth of the tool.

By having the spindle of the grinding wheel set at an angle approaching the vertical, each tooth of the tools can be ground without danger of ruining the adjacent teeth, which would result if the wheel spindle were in a horizontal position.

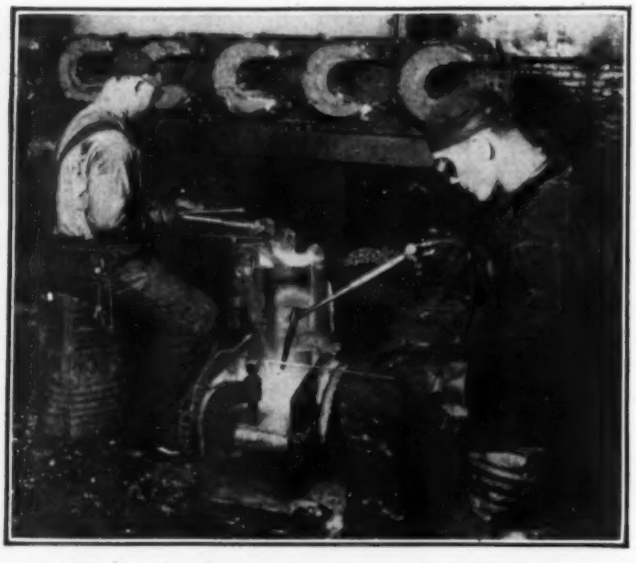
Repairing Locomotive Driving Boxes

By Milton Wright

The shoe-and-wedge faces of locomotive driving boxes are subjected to a great deal of wear, and various methods are adopted by different railroads to make compensation for it and restore the boxes to useful service. A certain amount of the original metal may be planed out of the channel in order to restore the wearing surface, but the number of replanings that can be made without reducing the thickness too much is limited, and a box would have to be scrapped from this cause long before its useful life was ended from wear in other respects.

The acetylene torch has made possible a simple and very satisfactory method of building up the worn surfaces so that the box is restored to its original size. The illustration herewith shows its application.

Pieces of boiler plate of suitable thickness are cut and planed to fit snugly in the channels of the box.



Welding steel plates on shoe-and-wedge faces of driving boxes

Two or more large diameter holes are drilled in each plate and countersunk deeply from one side. The plate is now set into the channel and the welder builds up studs of metal with the torch, fusing the new metal to the original metal of the box and filling up the countersunk holes in the plate.

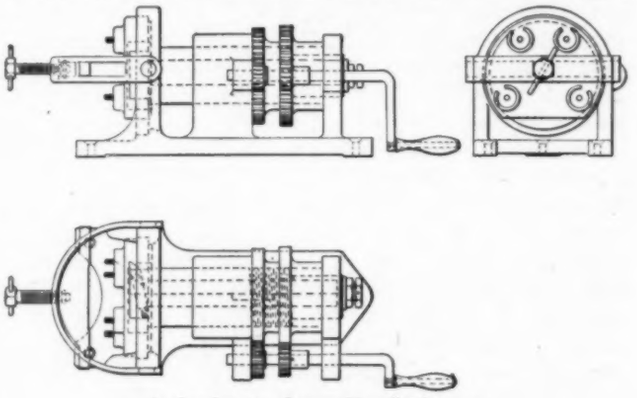
At each end of the inserted plate additional metal is laid on with the torch, welding it firmly in place. The box can now be replaned to its original dimension and is, to all intents and purposes, a new box. When the inserted pieces have become too thin by repeated replanings they can be removed and new ones put in.

A Home-Made Device to Bore Ford Timers—Discussion

By H. G. Dunn
Irthlingborough, England

On page 701, Vol. 63, of the *American Machinist*, Milton Wright describes a home-made device to bore the timers of Ford engines. If I may say so, the device illustrated herewith, which I designed some years ago, is very much in advance of the one shown by Mr. Wright.

We have over a hundred magnetos to keep in first-class order for bus work, and the problem of correcting



A device to bore Ford timers

the irregularities of the insets was being very badly tackled in the lathes, and at an excessive cost.

As may be seen in the drawing, I have employed a differential-screw feed that is equal to about 140 turns to the inch. The eccentric toolholder in the boring spindle is arranged so that by turning the pinned nut on the outer end of the spindle, the tool point is drawn in to a lesser diameter than when cutting, so that it may be withdrawn from the work without leaving scratches on the finished job.

The location of the part to be bored is by the standard diameter shoulder. The rest of the details will be obvious from a study of the drawing.

An Aid to the Draftsman

By Warren Scholl

A device commonly used by draftsmen in sharpening or touching up the points of their pencils, is a block of wood covered with abrasive cloth. While this little arrangement is excellent for the purpose, it leaves the lead of the pencil covered with some of the fine dust removed from the lead. If the dust is not wiped off, the triangles and drawings get smeared as the dust wears off. Of course, wiping a newly sharpened pencil on a rag will cure this trouble, but a rag is not always at hand.

A convenient device for the draftsman

If the draftsman will fold a piece of cloth and fasten it to one end of the sharpening block, as shown in the illustration, he will always have at hand a convenient substitute for a rag on which to wipe his pencil points.

Characteristics of Everdur Metal No. 50

EVERDUR is an alloy of copper, silicon and manganese of the solid-solution type that has physical properties comparable to mild and medium carbon steels, and the additional advantage of high resistivity to a large number of corrosive agents. The corrosion-resistant qualities make it suitable for the manufacture of pickling equipment, machine parts, pump units, pipe fittings and other uses where corrosion problems exist.

Physical Properties

The physical properties of Everdur are as follows: Melting point, 1,922 deg. F.; specific gravity (cast) 8.15, weight per cu.in. 0.294 lb.; specific gravity (rolled) 8.45, weight per cu.in. 0.305 lb.; shrinkage, $\frac{3}{32}$ to $\frac{1}{16}$ in. per ft., depending on the thickness of the section of the casting; hardness of casting (green sand), scleroscope, universal hammer, 12-15; hardness of cold rolled (unannealed), scleroscope, universal hammer, 38 to 40. The tensile strength in ultimate lb. per sq.in. is as follows: Green sand castings 50,000; forgings (bars forged from 2x2 in. to $\frac{7}{8}$x$\frac{7}{8}$ in.) 64,000; hot-rolled rods 75,000; rolled sheets, half hard, 80,000; wire, hard drawn, 0.025 in. in diameter, 157,000; cold-drawn tubing (as drawn) 98,000 and cold-drawn tubing (normalized) 69,000. The metal on repeated heating and cooling does not suffer any permanent growth.

Casting

Everdur casts readily in green sand, producing sound homogeneous castings of machining qualities. For crucible melting the metal should be melted in a quick fire with an oxidizing rather than a reducing atmosphere. Protection against oxidation from excess air in the combustion gases is had by carrying a 2- to 3-in. layer of charcoal on the metal during the melting. A full charge of metal in a No. 100 crucible, approximately the same weight of that used for ordinary bronzes, should melt down and be ready to pour in about two hours. The pouring temperature is between 2,100 and 2,300 deg. F. The metal should not be overheated. Pouring into the mold should be accomplished promptly. In charges composed entirely of new metal, 2 ounces of 10 per cent phosphor-copper are added to 100 lb. of metal, about 15 minutes before the crucible is withdrawn from the furnace, as a deoxidizer. During the melting, the metal should be stirred at least three times.

Green or dry-sand molds are prepared, gated and fed for the metal in substantially the same manner as they would be for phosphor-bronze castings of a similar character. Where an especially fine finish on the surface of the casting is desired in green-sand molds, the molds should be sprayed with deflocculated graphite in water and skin dried.

Heat Treatment and Annealing

Everdur may be annealed and softened at temperatures between 1,250 and 1,375 deg. F. Temperatures above 1,400 deg. F. should not be employed, as the grain growth increases rapidly above this temperature, resulting in a weakened structure. At 1,600 deg. F. the grain boundaries are shown to be between the solidus and liquidus; at 1,700 they are within the liquidus.

For removing strains in rolled or drawn metal, anneal at 1,300 to 1,350 deg. F. The degree of softness obtained will depend upon the time held at temperature. Ingots and billets for hot rolling should be given a soaking heat of from two to three hours after the soaking pits or heating furnaces have reached a temperature of 1,350 to 1,375 deg. F.

Forging and Rolling

Everdur flows rapidly under the hammer and may be forged without difficulty, providing proper precautions are observed. For forging, heat to a dull red, 1,100 to 1,200 deg. F. Working should be rapid with blows not too heavy. At higher temperatures, the metal has a tendency to become hot short and break under the hammer. Avoid fuels containing sulphur.

The best temperature for hot rolling is 1,300 to 1,375 deg. F. It is important that the ingot, bar or billet be thoroughly heat soaked before rolling. At this temperature the metal requires about the same mill power that wrought iron or mild steel requires at a temperature of 1,900 to 2,000 deg. F.

Pickling

For ordinary purposes the following pickling baths may be used: Sulphuric acid 10 to 25 per cent worked hot at about 140 to 160 deg. F. The addition of 3 to 5 per cent ferric sulphate to the bath will produce a better-looking product than sulphuric acid alone. Should the bath show any tendency to recopper the metal, it is an indication that more ferric sulphate is required. Another bath that may be used is hydrochloric acid 18 to 30 per cent worked cold, which quickly removes the black oxide.

Machining, Welding and Brazing

The machining properties of Everdur are practically the same as those of any high-grade bronze, and considerably freer than those of steel. For hot-rolled material (unannealed) the same tools may be used as for steel, but the cutting speed may be increased two to three times greater. For annealed stock and castings the same lathe speeds should be used as for bronze.

Everdur can be welded satisfactorily by either the oxyacetylene or the electric-arc process. The same methods as employed in oxyacetylene welding on bronze are generally applicable. The same fluxes may be used. Only bright Everdur wire or strips free from scale and dirt should be used for welding rods. The metal may be brazed and soldered in exactly the same manner and with the same tools that are used for copper and bronze. Borax or the same fluxes used for welding serve for brazing. Zinc chloride and hydrochloric acid make an excellent soldering salt.

The metal is the product of the Du Pont Everdur Co., Inc., Wilmington, Del.

For the data given, we are indebted to the manufacturer.

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Cutting Lubricant for Corrugating Rolls

Q. We would like to have your recommendations for a suitable cutting lubricant to be used in planing corrugations in corrugating rolls. These rolls are used in manufacturing corrugated paper and are of machine steel forgings. Our cutting speed is 25 ft. per minute.

A. We are quoting from the American Machinists' Handbook:

"A satisfactory compound for general work in drawn steel and soft steel forgings is made up of 40 gal. of water, 10 gal. of mineral lard oil (good grade) and 2½ lb. of soda ash (exactly measured).

"Half the quantity, or 5 gal. only of mineral lard oil, is sometimes used when a cooling rather than a lubricating element is desirable. This compound has worked well in pressed steel operations where others have failed."

There are a number of reputable companies who specialize in manufacturing cutting compounds. It would pay you to get in touch with one or more for recommendations on your problem before you proceed to making it yourself.

Varying Strength in a Cast-Iron Section

Q. I was recently told that the skin or scale of an iron casting constitutes its greatest strength, or, in other words, is stronger proportionally than the rest of the casting. Please set me right if this is not the case.

A. We believe that your informant has not conveyed just the correct meaning to you when you refer to the skin or scale of the casting having proportionally the greatest strength. The scale itself is a brittle and hard but thin layer on the outside that contains as many impurities picked up from the mold as it has iron content. This scale strictly speaking has no strength.

From the surface inwards, the coarseness of the grain structure gradually increases. This change, while hardly perceptible on a thin section, say ¼ in., is noticeable to a marked degree at the center of a 4-in. section. Naturally, therefore, on a thick section the metal near the center has not the strength, density, or homogeneous structure that will be found near the surface. On a thin section, properly poured, this difference is negligible.

The Most Economical Grade of Hydraulic Gasket

Q. Please tell us the advantages and disadvantages of purchasing only the highest grade of cup and U-gasket for use in hydraulic operating valves. We have had some discussion on the subject and are asking you to settle it for us.

A. The general, hydraulic gaskets in operating valves can be divided into two classes, other things being equal, those that pass ports in the valves and those that do not.

We suggest, in connection with the first class, that you determine whether the gaskets you use are being worn by the cutting action of the ports, or not, before the gasket has lost its body in other respects. If all but that part which becomes cut is in good condition we are of the opinion that you could save money by purchasing a cheaper grade for this service.

For those gaskets that are not prematurely injured by a port-cutting action, those of the second class, we believe you will profit by purchasing the best grade from the standpoint of wearability in service.

The Factor of Safety in Spring Design

Q. We noted your answer to the shop problem published on page 1058, Vol. 63 of the American Machinist, with reference to the use of spring tables in spring design. Please tell us if the allowable load figures given in these tables can be used without modification for any commercial condition.

A. The load figures given in the usual spring-design tables are the maximum safe loads for the springs in question and should be used in connection with the proper factor of safety. One of the handbooks places this factor at 2 for moderate operating conditions and 4 when there is rapid and continued reversal of stress as in the valve spring of an automobile engine. Thus if the table shows a load of 1,500 lb. for a given spring the figure on which the best design should be based is 750 lb. for moderate service. Conversely if the actual load is to be 500 lb. the figure sought in the table should not be less than 1,000 lb. When the extension or compression is to be but occasional, the figures in the table can be more closely approximated.

Push Button Valves in the Machine Shop

Q. We are interested in the use of air-gun or blow-gun valves, the type that ordinarily are operated by pressure upon a small push button, and their application in the machine shop.

A. Here are a few of the uses to which this type of valve can be put in the machine shop:

For cleaning castings both in the casting-cleaning room and in sand-blasting work, prior to machining.

For cleaning machines, motors and other equipment.

For blowing chips out of jigs and fixtures.

For blowing stamped parts out of press dies.

For blowing the scale, and sometimes components, out of forging dies.

For spray painting.

For gas welding and cutting equipment.

For operating unit signals and signal systems.

For particular uses in operating air chucks, air hoists, and air-line systems in general.

This last set of items should not be confused with the use of regular operating valves on purposes to which the push-button valve is not suited.

Technical Abstracts

Foremen's Conferences

George F. Dort, general foreman of the White Motor Co., gives his views upon a foremen's conference. At some meetings one frequently has the experience of disagreeing with the speaker on some policy he has put forth, but due to the way the meeting is conducted, the listener goes silently away dissatisfied in heart. At the foremen's conferences as put across by the White Motor Co., a free expression of opinion is invited and received with the general result that foremen leave the conferences completely satisfied that their viewpoint had been considered and discussed.

Each of the conferences left a new field in which to think and each new field meant a broader view of the job which was more than crossing that imaginary line of department division which exists in most caess between foremen. Co-operation frequently means that one foreman will set a job half over the line and wait for the other fellow to get the other half. The broadened view brought out by the foremen showed the other man's angle and made each one think of the other fellow's position. It is the thinking that must overlap, not the talking, and our thinking cannot even meet unless every one thinks about the whole problem in general and not merely about his own division, says Mr. Dort.—*The Foremen's Magazine*, Jan. 1926, p. 10.

Foundry Methods

D. M. Avey, in a review of foundry methods during 1925, says that conditioning, handling and conservation of sand have engaged much attention. The use of mixing, blending and aereating machinery has broadened. Prominent manufacturers of such equipment have developed complete units embodying conveyors to carry used sand to the mixing machines, mixers and revivifiers synchronized to work together, and elevating and discharge conveyors for carrying the prepared sand to molding machines.

One maker has designed a complete unit for sand return, that includes a continuous mixer, sand delivery, molding and mold conveying equipment. In line with the application of earlier ideas to advanced practice, the hydraulic principle to removing cores and adhering sand from castings after pouring has been adopted.

Simultaneous and independent progress has been made in several other permanent mold developments during the past year. It now is possible to cast fragile and intricate parts such as pistons, electric irons, small gear cases and even radiator sections from gray iron in metal molds. The tendency of castings of this nature to chill in the thin sections has been overcome in some instances by attention to the metal mixtures, to coating the surface of the mold and removing the castings as soon as the initial set is attained. —*The Iron Trade Review*, Jan. 7, p. 23.

Photo-Micrographs

Rather more than forty years have elapsed since photographs, taken at high magnifications, illustrating the micro-structure of metals and alloys, began to make their appearance in technical and scientific literature. At first they were largely ignored, but their growing insistence brought down upon them the scorn of the practical metallurgist and engineer.

How could photographs representing an area little larger than a pinpoint tell us anything of importance in regard to masses of metal that might weigh many tons? This was a natural argument, although even at that time the men who used it were also making use of the results of chemical analysis in which, in actual fact, a few milligrammes of sulphur or phosphorus has been detected and weighed or measured. The photomicrograph nevertheless has won its way steadily to recognition. Microstructures of most pieces of metal are so uniform that photographs taken from one part of a specimen, can fairly represent the whole of a large area. At the present time the study of micro-structure has attained very great practical importance.

Specifications are in use involving factors definitely depending upon micro-structure. The technique of polishing and etching has been developed considerably. The polished surface, if properly prepared, is almost featureless, except for a few scratches and holes, and the pattern is brought out by the etching process, usually a 1 per cent solution of nitric acid in alcohol, which brings to light the pattern which is investigated under a microscope.—*Metallurgist* (England). Dec. 25, p. 184.

Railroad Repair Shops

An editorial discusses the improvement in railroad repair shops saying that everyone familiar with railroad repair shops has realized for years the inadequacy and costliness of their operation. There are exceptions, for some of these repair shops are the last word in equipment and practice. But from this they range down, each lower class being larger than that above it, to shops which, seen through the eyes of machine tool men, are in the museum class, so old and inefficient are their tools.

Taking the extremes of the modern and the obsolete, the cost of a repair job in the one is many times the cost in the other. Even where machinery is not really old it is often no longer fitted to the task imposed upon it, because the nature of the task has changed. As Mr. Mitchell stated, in the last fifteen years there has been an enormous increase in the size and tractive power of locomotives, which has led to the adoption of large steel castings and of alloy steel castings and forgings. Naturally much more powerful tools are needed to accomplish the necessary repairs quickly and well. President Loree of the Delaware & Hudson R.R. has said, "Perhaps the point in which railroad facilities are the weakest is in the machine tool equipment of the repair shop." It is evident that cutting down the repairing time of a locomotive will increase its earning time.

A minimum of one extra trip a month would produce enough additional revenue to pay not only the fixed charges but return the entire capital investment each year."—*The Iron Age*, Dec. 31, p. 1615.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Unnecessary Accuracy

UNNECESSARY accuracy is a waste of time and money. While improved machinery and methods have made possible the attainment of accuracy that was only a dream a few years ago, we should not demand a tolerance of a half-thousandth when five thousandths will answer equally well. And if a sixteenth is good enough, say so on the drawing.

In too many cases customers talk about tenths of thousandths without realizing what it means and without a method of measuring to any such accuracy. When a bidder knows this he might easily count on the buyer's inability to check up and put in a lower price than the man who actually made the tool within the prescribed tolerance.

The work of the Plain Gage Committee of the American Society of Mechanical Engineers, as shown in its report on Tolerances, Allowances, and Gages for Metal Fits, can be used as a guide in setting tolerances for fits of various kinds. These tolerances were set after long and careful study of the best practices and will be found applicable to nearly all classes of work. They will save wasting time in unnecessary accuracy and prevent many rejections and delays that now occur. Copies of this report can be had from the A.S.M.E. headquarters.

Two Years to Reorganize the Government

REPRESENTATIVE Davey's bill H.R. 4798 proposes to enlarge the powers of the President for a period of two years so that he can undertake a real reorganization of our unwieldy and overmanned Government. There is naturally considerable doubt whether any Congress will ever be broadminded enough to pass any bill increasing the powers of the executive division, even for a limited period.

Reorganization is a crying need and has been recognized as such for many years. President Taft attempted it and it was one of the pet projects of the late President Harding. President Coolidge is well aware of the situation as is shown by his recent statement that economy in Government expenditure has about reached its limit unless reorganization of departments and elimination of useless employees is made possible.

It is useless to expect Congress to work out a reorganization plan. That has been tried and has failed. The only solution, therefore, is to entrust it to the President just as it would be turned over to the executive head of a commercial enterprise.

A further provision of Mr. Davey's bill is that steps be taken to raise the pay of the deserving employees that will be left when the useless ones have departed. Ten per cent of the savings effected can be applied to this end under the terms of the bill. Let us hope that something comes of it all.

The Widening Use of Machinery

WE GET so accustomed to seeing big things that we lose track of the fact that they are the exception rather than the rule. We go through a large motor shop employing several thousand people and come out with the notion that it is a typical American plant.

As a matter of fact the average or typical plant does not employ over 200 people. But the sum of these foot up to an amazing total.

We are very apt to forget about the thousands of small shops that use a few machines each, and think only of the large batteries we see in the big shops. Nearly every shop is using more and more equipment. The blacksmith or millwright now has an electric drill mounted on an upright instead of the old hand operated post drill. He has a welding outfit of some sort and if he handles automobile work, as he probably does, he carries a supply of reamers and other tools that he never thought of before.

Add to these the number of motor-driven machines in the modern house, the use of hoists, motor shop trucks, conveyors and the like and there is no end to the things that demand machinery in the making. This is the machine age and the making of these machines means shop equipment of all kinds.

Just Suppose

JUST suppose that, so far as ethics go, the whole of any organization should be told just what is expected of it. That there were no reservations, especially mental, on the part of the higher-ups. That management should openly stand for ethical or unethical practices, by word according to deed.

A good bit like the honor system in taxes, perhaps. Well, that hasn't made the world any worse. There is something in getting a man to thinking about what he says in regard to ethics as well as taxes.

Just suppose.

Shop Equipment News

"Hartford" Automatic Production Milling Machine

The Hartford Special Machinery Co., Hartford, Conn., is placing on the market a milling machine that is specially designed for rapid production of manufactured parts within a limited range of sizes and where the conditions are favorable to long runs upon one kind of work. It is semi-automatic in its movements, requiring no attention from the operator except to unload and reload the work.

The machine is arranged for a single-speed drive by belt from either overhead lineshaft or special motor. Power is transmitted to the spindle through a train of speed-reduction gearing. The spindle is of steel, hardened and ground, and runs in steel sleeve bearings that are also hardened and ground, and are adjustable to compensate for wear. The cutter arbor is made integral with the spindle and is provided with the usual collars and nut to hold the cutters. The overarm has a full bearing in the head and is very rigid.

The casting upon which the head is carried is pivoted to the base in such manner that it can be tilted to allow the cutters to clear the work. The fulcrum point is at the extreme right end of the main casting, behind the vertical face upon which the head is mounted. At the opposite end the weight of the casting and head is borne by hardened steel adjusting screws, resting upon hardened bearing plates.

The construction of the parts is such that no wringing or twisting movement can take place. The tilting is brought about by means of a cam upon the table drive shaft and occurs at the end of the cutting stroke. Its purpose is to raise the cutters above the work during the return movement of the table and thus avoid marking the latter. The amplitude of the movement is just sufficient to insure clearance.

Fig. 1 shows a front view of the machine. In Fig. 2 the drive to the table may be seen as it appears when the hinged guard is swung back to expose the gears. From a small sprocket upon the main spindle a chain drives the first member of a change train by means of which the speed, or frequency, of the cycle is determined. The table is actuated by a cam, which governs the amplitude of stroke. The mounting of the cam is such that it may be interchanged readily with others of different contour, thus making available a variety of table movements; uniform, accelerated or intermittent as desired.

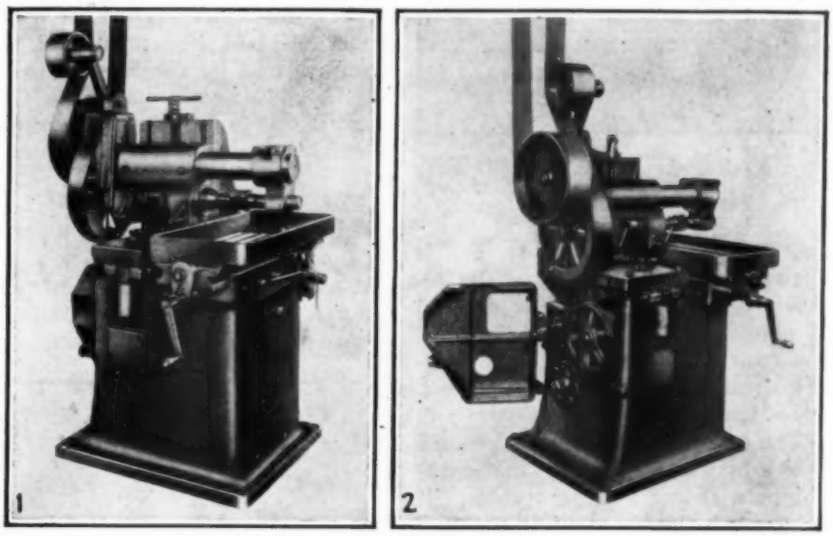


Fig. 1—"Hartford" Automatic Production Milling Machine. Fig. 2—Rear view showing drive to table

One revolution of the camshaft constitutes a cycle of the machine, the table being returned to its starting point by the abrupt drop of the cam. Owing to the nature of this movement it may be confined to a very few degrees of rotation of the cam shaft. Upon the return of the table the cycle movement stops automatically and awaits the reloading of the work-holding fixture. The movement may be interrupted at any point by means of a finger lever.

The position of the table lengthwise of the stroke is adjustable with reference to the cam movement by means of a screw and crankhandle. The maximum automatic movement is 6 in. and the milling movement is 4 in. or less according to the contour of the cam used to produce it. The speed of the cycle is determined by the ratio of the change gearing in the table drive, and may be altered to suit the nature of the work by changing the gears.

All rotating parts except the main spindle — including the adjustable idlers to take up the slack of the driving belt and of the chain that drives the table movement — run upon ball bearings. The machine occupies a floor space of 58 x 42 in. and weighs about 2,000 pounds.

"Beryllium"

The Beryllium Corporation of America, 5005 Euclid Ave., Cleveland, Ohio, has placed on the market metallic beryllium. The physical characteristics claimed for the alloy are a weight ⅓ lighter than luminum and a melting point of about 1,275 deg. C. It is for use in conjunction with other metals where special properties are sought. It can be combined with aluminum, copper or silver. With aluminum, it is said to form a series of alloys of high melting point. It is used with copper to increase the tenacity and hardness of bronze alloys and for color effects.

Shop Equipment News

Murchey Revolving Diehead, Type O, Improved

The Murchey Machine and Tool Co., 953 Porter St., Detroit, Mich., has improved its type O revolving diehead, illustrated in Figs. 1 and 2. The diehead is shown ready for use

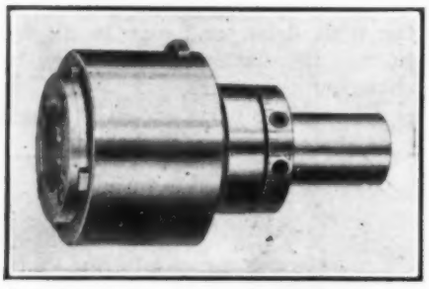


Fig. 1—Murchey Revolving Diehead, Type O, Improved

in Fig. 1, and in Fig. 2 the shell is shown moved back to allow the removal of the chasers. The diehead is similar in general principles of construction to the type P tool previously described on page 380, Vol. 60, of the *American Machinist*.

The type O diehead is so designed that it may be used on automatic machines with a revolving spindle. It is opened by means of a trip provided on the machine and is closed by means of a yoke when the spindle is returned.

Removal of the chasers is accomplished without taking off the cap and without the necessity of removing the tool from the spindle of the machine. By removing the "spring stop collar" shown in Fig. 1 between the shell and the adjusting ring, the shell is allowed to slide back into the position shown in Fig. 2. The chasers can then be easily removed. To replace them, it is necessary only to set them in their proper slots,

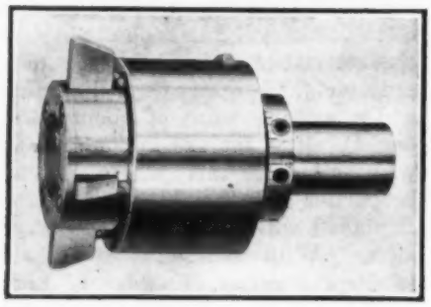


Fig. 2—Position for removal of chasers

press them down against the "locating pins" and to bring the shell forward. The spring stop collar then can be replaced.

Advantages claimed for the diehead are that the chasers can be quickly removed without the aid of a screwdriver and that the location of the adjusting ring is a convenient one. All parts are hardened and ground.

"Rego" Fire Stopper

The "Rego" fire stopper, of which model 4-11-44 is illustrated, is manufactured by the Bastian-Blessing Co., 240 East Ontario St., Chicago, Ill. It is intended for garages, power stations, industrial plants or private buildings.

The extinguisher is composed essentially of two parts, a cylinder to hold compressed carbonic acid gas and a cone to be filled with powder. In use, the valve in the tank is opened as much as may be necessary.

"Rego" Fire Stopper

The escape of the gas creates a whirling action in the cone and projects the powder through the nozzle in a stream that has a range of about 25 feet.

The original carbonic acid gas has a smothering effect on the flame, while the powder, when it comes in contact with the flame, decomposes into carbonic acid gas and water steam and the remaining powder will blanket the flame in much the same manner as would a similar amount of sand. Tests are said to have shown that the powder is a non-conductor of electricity and can be used against electric fires on circuits up to 160,000 volts without danger to the operator.

Advantages claimed for the extinguisher are that it can be stopped at any time while in operation and can be used again without recharging and that it leaves no injurious byproducts.

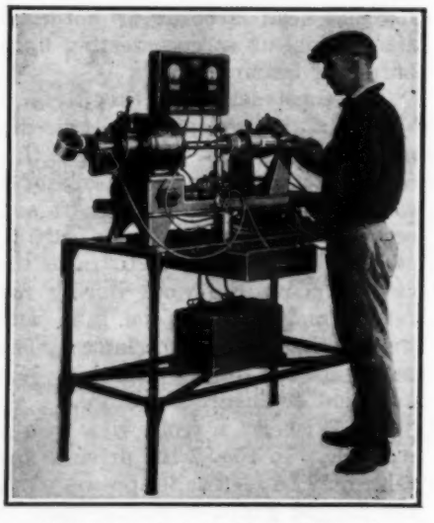
The capacity of the cone is for 2 gal. or 17 lb. of powder and the total weight of the apparatus, when charged, is 32 pounds.

Hobart Electrical Test Bench

The electrical test bench illustrated is being manufactured by the Hobart Brothers Co., Canal Lock Square, Troy, Ohio, for locating troubles and testing out automatic starting motors, generators or other electrical equipment. The illustration shows the testing of a portable drill.

The test bench is equipped with a 1½-hp. Hobart, reversible, variable-speed motor. A tachometer indicates the motor speed. The set has two-point spark gap and a rotary spark gap graduated in 360 deg. A silent flexible coupling is used between the motor and the chuck which has an adjustable flexible mounting. The vise is designed to handle all sizes and types of generators and starting motors.

The switchboard is of bakelite and the switches are all of the inclosed



Hobart Electrical Test Bench

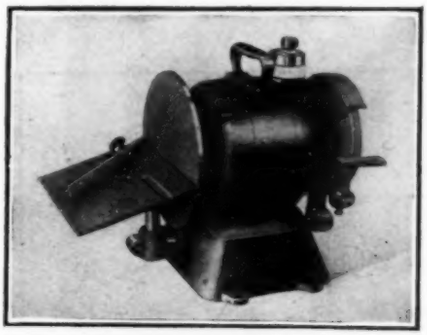
Shop Equipment News

tumbler type. Test sockets with external leads and a condenser with in and out plugs are provided. The ammeter has a range of 30-0-30 and 600-0-600, while the voltmeter has a 0-25 range. It has a 110-volt test lamp and a complete torque test fixture.

The bed is of cast iron and has a tool rack on the side. The table for the equipment is of steel and it is provided with a steel drawer.

Winterhoff Grinder and Disk Grinder, No. 2

Included in the line of small motor-driven tools manufactured by the Winterhoff Tool and Machine Co., Elkhart Ave. & Jackson St., Elkhart, Ind., is the No. 2 grinder



Winterhoff Grinder and Disk Grinder, No. 2

and disk grinder, illustrated. The machine carries one disk wheel and one tool grinding wheel. A No. 1 grinder is similar to the No. 2 machine but carries a second tool grinding wheel instead of the disk wheel.

The base of the machine carries the motor and two supports mounting the wheel guards, the toolrest and the tilting table for the disk wheel. The grinding wheels are mounted directly on the motor shaft.

The tool grinding wheel is 6x½ in., for a ½-in. arbor. The metal disk wheel is 8 in. in diam. The tilting table is grooved for a protractor guide. A ¼-hp., a.c. motor with its switch built in is used for power.

The inclinable table for the disk wheel can be adjusted and clamped in any position. The toolrest for the tool grinding wheel has a similar means of adjustment. Setscrews secure the toolrest in its position.

Badger Grinding Fixture for Leaf Spring Eyes

The Badger Tool Co., Beloit, Wis., has adapted one of its disk grinding machines for the grinding of the sides of leaf spring eyes. These eyes are ground parallel and to size.

The machine is fitted with two built-in, 10-hp. motors for driving the main grinding spindles and a separate 1-hp. motor with a suitable cone pulley for operating the power fixture mechanism at different speeds. Abrasive cylinder wheels, 18x1½in., held in chucks, are used as grinding members. The wheel dresser can be mounted at the front or at the rear of the machine.

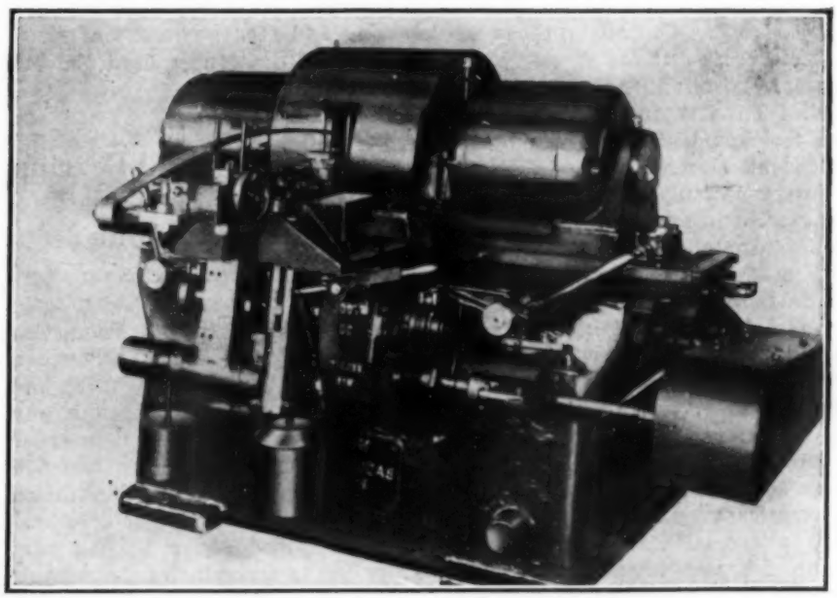
The spring holder is constructed in the form of a ram which carries the spring in between the grinding wheels and out again where it stops for reloading. The grinding heads open as the spring enters and close down to micrometer stop screws. Separate screws are provided on each head so as to compensate for uneven wear of the grinding cylinders.

It may be seen from the illustration that the grinding heads are opened by means of cams driven through a reduction gear box. The cams act on roller levers that are connected to the grinding heads through a rack and pinion. The heads are brought together by means of weights supported on arms at the rear of the machine.

The ram is caused to travel in between the wheels by means of a weight and lever, and it is brought back into loading position by means of a double cam driven through reduction gears. One of the ram-operating cams provides a constant and short stroke while the spring is between the grinding wheels. The tripping of the hand lever, shown at the front and top of the gear box, causes the ram to automatically back entirely out from between the wheels and to stop. With this control, it is possible to make only one pass between the wheels, as when it is necessary to grind to a size, or the ram can be reciprocated continuously, as may be desired.

The machine is built in both belt- and motor-driven types and is arranged for either wet or dry grinding. The complete unit weighs 4,500 lb. and requires an operating floor space of 8x11 feet.

This adaptation of the disk grinding machine is one of a series developed by the company. The fixtures that are used are designed for special purpose work. A previous adaptation of the No. 221 grinding machine was described on page 1073, Vol. 63 of the *American Machinist*.



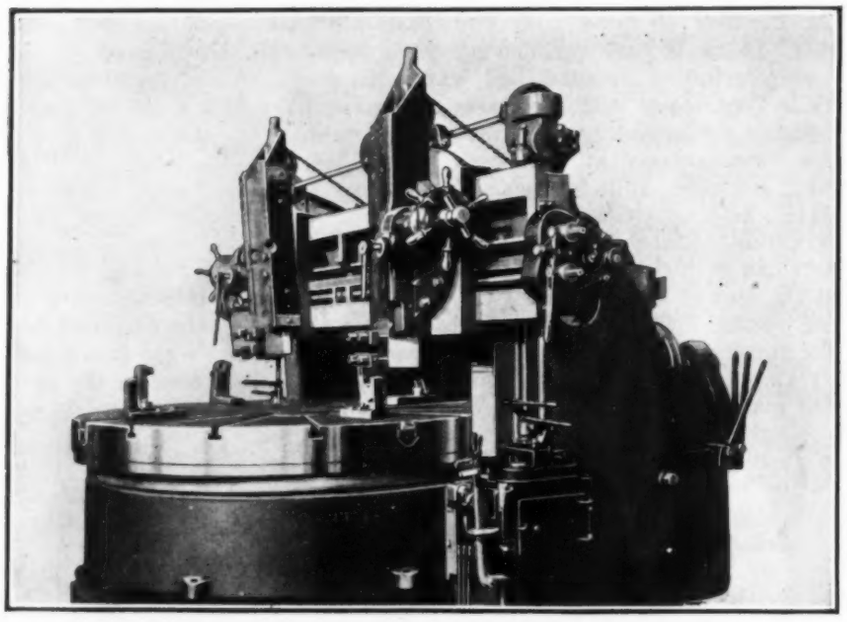
Badger Grinding Fixture for Leaf Spring Eyes

Shop Equipment News

"Betts" Tire Mill, Improved

An improved design for its vertical tire mill has been developed by the Betts Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. The illustration shows a 96-in. machine which a heavy design to withstand the thrust of form tools when turning threads.

Continuous feed is provided for the machine. There are eight feed changes operated through sliding



"Betts" Tire Mill, Improved

has a swing of 100 in. Models similar in design have been built also in sizes of 66, 72, 84 and 108 inches.

The machine has a narrow-guide cross-rail which has a wide face. No vertical adjustment is provided on this model, but machines of similar design can be built with an adjustable cross-rail for shops requiring more room under the tools. The saddles have rapid power traverse. The tool spindles are driven by independent electric motors and are of heavy rectangular section. They are carried in swivels having square guides throughout. The spindles as well as the saddles are of steel.

The table is of deep construction and is driven by steel internal gearing of large diameter, wide face and course pitch. It is equipped with a four-jaw universal chuck for centering the tires. The four jaws can be operated by moving any one of them so that the work is centered automatically. Each jaw is provided with a special eccentric hold-down clamp for use when boring. The clamps can be tilted back to facilitate the removal of the tire. They are of gears. The gears are fully inclosed and run in oil. The gear box is built into the bed between the uprights at the rear. Feed and rapid traverse may be engaged, disengaged and reversed by means of two levers located just above each feed box. All driving and feed gears are of steel. Alemite lubrication is used for the main bearings.

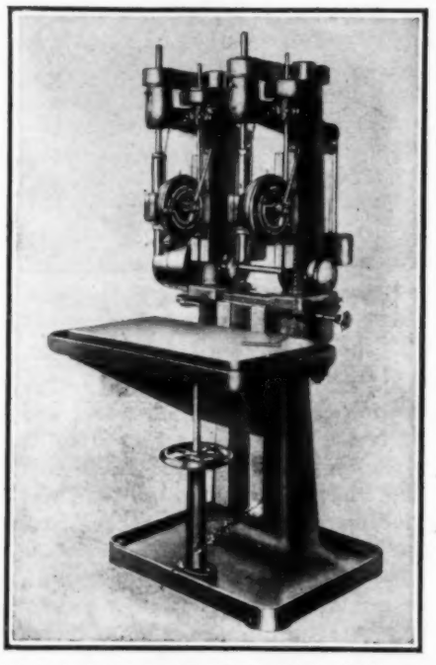
Taylor & Fenn Ball Bearing Adjustable-Head Drilling Machine

A line of ball bearing manufacturing drilling machines is being marketed by the Taylor & Fenn Co., Hartford, Conn. The machines are designed for single-pulley drive and for production work, although any size of pulleys can be used in order to give spindle speeds of from 575 to 2,300 r.p.m. The illustration shows the No. 32 two-spindle machine, but models can be had with from one to six spindles.

The heads of the machines are adjustable on the columns. The maximum distance between the spindles of the No. 32 machine is 16 in. and the minimum distance is 8 in. The vertical adjustment of the spindle bracket is 7 in., and that of the table is 15 inches.

The distance of the spindles from the column is 8 in., the minimum diameter is $\frac{7}{8}$ in. and the diameter of the spindle nose is $1\frac{3}{8}$ in. It is bored for a No. 2 Morse taper. The table surface of the model illustrated is 16x32 inches.

Power as well as hand feed can be provided for the machines. The $5\frac{1}{2}$ in. of total spindle traverse is made through one revolution of the lever. The maximum distance from the spindle to the table is 25 in. The power feed is variable. It automatically increases when the spindle speed is reduced. The maximum feed of 0.006 in. and the minimum feed of 0.003 in. per revolution of the



Taylor & Fenn Ball Bearing Adjustable-Head Drilling Machines

spindle is regulated by the diameter of the pulleys on the spindle and on the rear shaft.

A slight pressure of the drill against the work is said to be sufficient to engage the power feed. If necessary, the feed can be disengaged before the full depth of the hole is reached, by lifting the hand feed lever. Provision is made for locking the power feed when it is necessary to feed by hand.

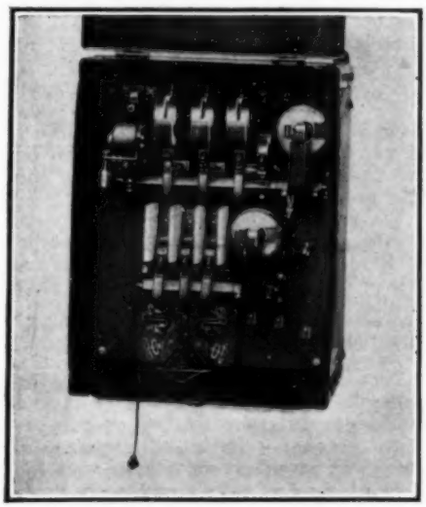
Shop Equipment News

The bracket for the motor is attached to the column and is adjustable. Motors of 1,150 r.p.m. and of from 1 to 3 hp. are required according to the number of spindles. The oil system includes a pump, tank, piping, feed tubes and valves attached to the machines.

The net weight of the No. 32 drill is 1,180 lb. The weight of the power feed head and of the tapping head is 75 and 20 lb. respectively.

General Electric Resistance Starters, Improved

The primary resistance starters, manufactured by the General Electric Co., Schenectady, N. Y., for squirrel-cage, induction motors,



General Electric Resistance Starters, Improved

bearing the designation CR-7056-D-1, have been superseded by two improved types, the CR-7056-D-3, illustrated, produced in sizes for use on motors up to 25 hp., and the CR-7056-D-4 for motors of from 25 to 50 hp. The former has arc barriers and the latter is equipped with magnetic blowouts and arc chutes to handle the larger motor currents.

Both starters have an improved magnetic time interlock. The operating spring now works by compression instead of tension. The interlock can thus be adjusted more easily. The starting resistors have been redesigned to provide a greater capacity and to conform to Classification No. 16 of the Electric Power Club, which provides for 200 per cent full load current or more on the first point for 15 sec. out of every four minutes.

The case for the D-3 starters opens from the top and is ventilated. It has two 1¼-in. knockouts both in the top and in the bottom, providing ample space for the power and the control wires. The cover may be padlocked shut if desired. The D-4 case is larger than that of the D-3 to accommodate a larger resistor. This case opens on the side and can also be locked. It is provided with four knockouts 2 in. in size.

Both models are arranged for wall mounting and weigh 122 pounds.

Woodward & Powell Crank Planer 36x36-Inch

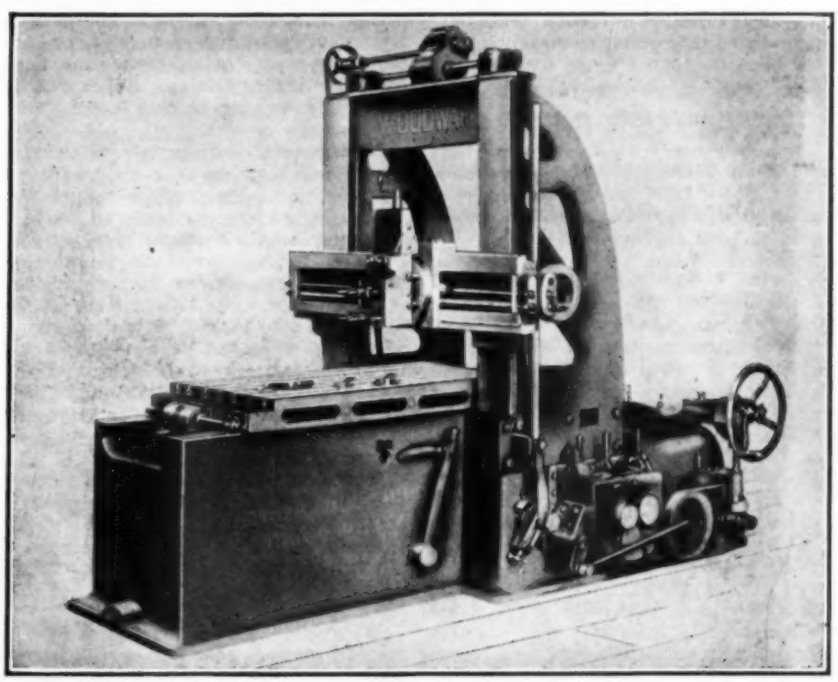
The 36x36-in. crank planer, illustrated, has been added to the line manufactured by the Woodward & Powell Planer Co., 97 Webster St., Worcester, Mass. The 24x24-in. model was previously described on page 964, Vol. 54, of the *American Machinist*. The maximum stroke of the 36x36-in. machine is 42 inches.

The table is of box form and the work can be placed anywhere upon it to come under the tool. The table drive is through a herringbone pinion and gear and a slotted rocker mechanism. The pin on which the slotted rocker oscillates is supported at both ends, making a rigid construction.

The design of the housings is uniform with that of the other machines in the company's line of planers. The housings are of box form and extend down over the side of the bed where they are bolted. The head is of the same size and design as that used on the company's standard, rack-driven, 36-in. planer. It has the usual horizontal, vertical and angular feeds either by power or by hand. The cross-rail has power elevation. A side head can be furnished if desired.

Six changes of speed are furnished on this model. They are 6, 8, 12, 17, 24 and 34 strokes per min. The changes are made through sliding gears mounted in a gear box at the front of the machine. The length of stroke is changed by means of a handwheel located on the operating side of the machine. A dial adjacent to the handwheel indicates in inches the length of the stroke.

The machine can be driven from a single pulley belt or from a 10-hp., constant-speed motor.



Woodward & Powell Crank Planer, 36x36-Inch

News of the Week

France Not Yet Over Effects of Financial Instability—Export and Import Figures Show Economic Losses

New finance bill adds to heavy burden of taxation—Selling prices fluctuating—Labor conditions not sound

BY OUR PARIS CORRESPONDENT

The end of the year brought no economic peace, whatever may be the fate of the new Doumer finance bill. Its most annoying provision, one that taxes all sales an additional 1.2 per cent, will unquestionably put a further brake on trade. The manufacturer, the jobber and the retailer will each add some trifling figure as the product passes through his hands, and this total may reach 5 or even 10 per cent. The final consumer will pay.

The defects of the project are seemingly recognized by the minister of finance and his associates but it is claimed that it is the only method for getting some spot cash into the treasury coffers. The manufacturing and the selling trades have not yet delivered their ultimatum, but the consuming public is already protesting and in its wrath uttering such words as boycott and strike.

Of non-ferrous metals only aluminum has remained stable in price during the past month. Copper, tin, lead and zinc have risen from 5 to 10 per cent. Gasoline and fuel oil have increased 10 per cent and railway freights and passenger fares, according to classification, have been increased from 6 to 30 per cent.

GOVERNMENT STILL BORROWING

The government on its part has borrowed another 1,300,000,000 francs from the Bank of France which concurrently printed 1,152,307,000 paper francs to meet the demand.

The new finance bill, considering the opposition of the political "Left," will have a difficult passage when it gets through parliament.

The probable tariff revision will soon be brought forward again fraught with imminent danger to imports from abroad. Deputy Landry has asked the tariff commission to adopt a high protective policy on all key industries and those which may be of value as elements of national defense or national prosperity. This opens a wide range of attack on many manufactured and semi-fabricated products of which those of the metal trades are by no means the least important. The same parliamentarian asks also that customs dues be figured on a gold basis varying with the value of the dollar in francs from day to day.

The new finance bill provides also an additional tax of 1.3 per cent on export sales. With this handicap on export, and the 1.2 per cent tax on home sales, the situation is becoming complicated for industry and trade.

An apparent activity in the French machinery and tool trade does not necessarily indicate prosperity. Conditions in the Lyons district may be taken as typical. Busy plants give an illusion of prosperity but the worker, with his recently increased wages, is the chief gainer, it is claimed. Raw material prices and transport charges alike have risen during the past quarter year. The index figure of general industrial materials rose from 643 to 722 during the period and that of minerals and metals from 581 to 674.

SOME BUSINESS GOOD

The textile machinery industry is satisfactory with exports to Italy, Spain and even England. Wire goods are also finding export orders. Hoisting machinery production is still satisfactory in a measure but rolling stock plants have reduced labor appreciably. Electrical appliances, machinery and tools are very satisfactory but hampered by delivery delays. Boiler makers in mid-France report satisfactory business.

In a general way cost price instability is bringing as a consequence instability in selling prices which are fluctuating, more particularly rising.

Eleven month's imports of 34,448,342,000 francs showed an increase of more than two billion francs over the same period in 1924. Exports of 35,142,577,000 francs signalled a gain of a like amount. Imports from the United States, Great Britain and Germany all showed increases; and exports likewise. November imports in general showed an increase in value and a decrease in volume.

A developing industry in France is the manufacture of automatic scales of small capacity for the retail trade. Heretofore the old Roman steelyard or the two-dish balance had served. There would seem to be an immense field and little competition as yet.

Wire nail manufacturers have increased prices and a working agreement has been arrived at, or is imminent, in the nut and bolt industry toward standardizing prices. Steel stampings are finding less demand at home than production facilities can furnish and there is a disposition to cut prices for export to meet German competition. Small tools are quiet with a tendency to rise in price. Competition in files is growing.

The automobile industry in home markets has seen its product hang fire these last weeks and in general has come to the belief that the only hope of filling plants with orders is to cut prices on export business. Absorption limits have been by no means reached in France, but high prices are shutting off business which might otherwise materialize. The new model Ford in the French market is still from five to eight thousand francs in price under anything which will compete with it efficiently. One French firm claims to have sold three thousand 7-hp. cars in Germany but the new German tariff is making itself felt there as in most other world markets. Citroen is said to be about to abandon the construction of his 5-hp. model and concentrate on the 10-hp. with a view to meeting the fast growing Ford competition.

Eleven months' automobile imports numbered 16,129 units as compared with 11,158 units in 1924, with an increase in value of more than fifty million francs.

PROTEST GERMAN PRIVILEGE

Protest is still vigorous against the policy which allows German tools and machinery to enter France on reparations account. It is of moment to American exporters as well, in that the German product enters under the minimum tariff and thus in price competition at least meets both French and American competing lines on a privileged basis. French agricultural machinery makers are complaining loudly, as they were just getting a fair volume of business in certain lines.

French sewing machine manufacturers are following suite. While their industry is, for the moment, less important, they are feeling German competition. It is claimed that French makers are turning out 70,000 sewing machines a year and that imported units number nearly a quarter of a million.

The labor situation is apparently less stable, some readjustments having taken place by slowing down of various industries. In general, however, all this non-specialized labor has been absorbed by other occupations. In spite of the demand and desire for foreign labor some sort of new labor legislation is about due for France. This in view of allowing entry only to those of certain categories of service where there is actually a shortage of native labor.

Aviation Problems Occupy Attention of Automotive Engineers in Convention

New president stresses importance of production

Aviation once again attracted the greatest attention at the annual meeting of the Society of Automotive Engineers held at the General Motors building in Detroit, Jan. 26 to 29. Something over 500 members and guests registered, and all the technical sessions were well attended. About a thousand enjoyed the Carnival and more than a hundred others had to be turned away.

At the business meeting on Tuesday evening the usual annual reports were presented and President Horning read his final address to the society. Among the many accomplishments of the society to which he called attention were the high development of the gray-iron casting, which has largely replaced aluminum castings in many units; the advancements in body design through which the driver's range of vision is enlarged; the steps taken to improve traffic conditions.

The new president, T. J. Litle, Jr., chief engineer, Lincoln Division, Ford Motor Co., urged upon the members closer contact with the production side of the industry and suggested that if any of them had sons coming out of college they be allowed to work their way up through the shop to executive positions.

In a remarkably well presented paper, following the business meeting, Grover C. Loening, Loening Aeronautical Engineering Corporation, traced the development of the amphibian type of airplane and pointed out its wide usefulness for all types of aeronautical work. Mr. Loening paid tribute to the hardihood and daring of the flyers who accompanied the MacMillan expedition last summer. He closed his talk by showing motion pictures taken in the Arctic regions by those men.

At the aeronautic session on Wednesday, Ralph H. Upson, Aircraft Development Corporation, talked on metal-clad rigid airship development. He told of the progress made with a ship of this type and compared its safety and economy with similar factors in ships of the Shenandoah type. Dr. Arnstein, former chief engineer of the Zeppelin interests and now with the Goodyear aircraft division took exception to a number of Mr. Upson's statements regarding the qualities of rubberized fabric. The other paper presented at this session was by H. F. Parker and the subject was "The Economic Spheres of Usefulness of Airship and Airplane."

Automobile engine supercharges were considered at one session, papers being read by C. R. Short and C. W. Iseler of the General Motors Corporation. Engine starting tests and an improved type of refrigerated test chamber were described at the Research Session by J. O. Eisinger, of the Bureau of Standards, and D. M. Pierson, Dodge Bros., Inc., respectively.

At the Brake Session, H. H. Allen, of the Bureau of Standards, reported that the apparent coefficient of friction of brake linings decreases with heat and as the lining becomes wet with water or oil. Dr. F. C. Stanley, Raybestos Co., said that brake squeaks of high pitch are caused by vibration of the brake drum. To prevent them the drum must be round within 0.0008 in. and the lining must be concentric.

Color harmony and the pigments used in automobile colors were discussed at the Body Production Session by H. L. Towle, DuPont, and C. A. Greene, Valentine & Co. The Engine Session brought out a paper by A. C. Attendu, Eastern Engineering Co., Ltd., on a small, flexible, heavy-oil engine that has shown promising test results for automobile and aviation work. At the same session T. E. Coleman, Madison-Kipp Corporation, and J. B. Fisher, Waukesha Motor Co. reported test results that proved the ordinary motor car engine to be over-lubricated.

Headlights were discussed at a symposium on Thursday afternoon and motor coaches in the evening. Steam or vapor cooling of automobile engines occupied the stage on Friday morning and fuels and lubrication on Friday afternoon. At a simultaneous afternoon session, Joseph Lannen, of the Paige-Detroit Motor Car Co., described the application of the group bonus to non-productive labor and J. Ledwinka, of the E. G. Budd Manufacturing Co., showed motion pictures of the construction of all-steel bodies.

Dreses Will Build New Plant

The Dreses Machine Tool Co., of Cincinnati, has awarded a contract for a new plant to cost $100,000. The Austin Co., of Cleveland, is the engineer and builder.

The new Dreses plant will be of one story design 90 x 300 ft., with monitor. About 100 tons of structural steel will be required. Cranes will be installed, two 5-ton cranes in the center aisle and one 3-ton crane in the side aisle. The Austin company's contract includes heating, lighting, plumbing and erection of cranes in addition to construction.

Charles E. Gilbert is president of the Dreses company; W. A. Hudson is secretary and treasurer. Mr. Gilbert is also interested in the Buckeye Foundry Co.

Begin Hearings on Metric Bill

Representative Perkins, of New Jersey, on Jan. 23, announced the opening of hearings on the Britton metric system bill. The hearings began February first.

The membership of the committee which will determine whether or not this bill is recommended to the House of Representatives is composed as follows: Representative Perkins, of New Jersey, chairman; B. G. Lowrey, of Mississippi; Albert H. Vestal, of Indiana; Charles L. Abernathy, of North Carolina; Lloyd Thurston, of Iowa; Edgar Howard, of Nebraska; Harry I. Thayer, of Massachusetts; Andrew L. Somers, of New York; F. W. MaGrady, of Pennsylvania; John J. Douglass, of Massachusetts; Florence P. Kahn, of California; Oscar L. Auf der Heide, of New Jersey; John M. Wolverton, of West Virginia; Bolivar E. Kemp, of Louisiana; Florian Lampert, of Wisconsin; R. A. Green, of Florida; O. J. Kvale, of Minnesota; and Dan A. Sutherland, of Alaska.

Machinery Exports Still Show Increase

Exports of metal-working machinery for December, with revised comparative figures for December, 1924, as compiled by the Department of Commerce are as follows:

	December 1924 Value	December 1925 Value
Lathes	$95,727	$314,305
Boring and drilling machine tools	83,227	43,712
Planers, shapers and slotters	30,758	30,014
Bending and power presses	157,552	58,568
Gear-cutting machines	14,818	32,824
Milling machines	112,166	108,036
Thread-cutting and screw machines	64,173	100,579
Punching and shearing machines	4,111	12,850
Power hammers	13,443	27,704
External grinding machines	133,043	111,442
Internal grinding machines	27,997	42,713
Other grinding and sharpening machinery	33,093	70,762
Chucks for machine tools	20,573	23,258
Reamers, cutters, drills, taps, dies and other metal-working tools	153,386	167,539
Pneumatic portable tools	75,898	158,901
Foundry and molding equipment	38,845	72,053
Other metal-working machinery and parts of	306,074	616,712
Metal-working machine tools		
Total	$1,364,884	$1,991,972

Will Discuss Methods of Stabilizing Business

"Stabilizing Business" will be the main theme of the annual convention of the American Management Association at the Hotel Astor, New York, on March 3, 4 and 5. The program will consist mostly of committee reports.

There will be meetings for financial and office executives on: "Rating Office Employees," "The Office Supervisor's Part in Training," and "Meeting and Minimizing Peaks in Office Work."

For production and operating executives there will be group meetings on: "Rating Manual Workers," "The Foreman's Part in Training," and "Planning and Maintaining a Regular Flow of Work."

For sales executives there will be group meetings on: "Rating Salesmen," "The Sales Supervisor's Part in Training," and "Marketing Policies and Sales Methods that Stabilize."

"What's Ahead for Management" will be the theme of a luncheon meeting on March 5, at which Mrs. Frank B. Gilbreth will present the main paper.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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BUSINESS is like the weather in that a storm is generally followed by a calm, and it is plain that we are now entering upon a period of comparative calm in so far as speculative enterprise is concerned. Just how long it will last and in how far it will affect the trade of the country are questions that no one can answer.

The precedents suggest that the consumptive demand and purchasing power of the people will not be much restrained by a subsidence of speculation on the exchanges, but it is nevertheless true that a serious decline in the stock market, if it occurs, might somewhat chill the enthusiasm for the future that has been so general until recently.

Then too, the many warnings that are being issued are making people more cautious. The number of such warnings is increasing.

Private advices from Florida say that the boom there seems to be quieting down and that there are more sellers than buyers of real estate, while a dispatch from Chicago announces that a distinct lull in building is noticeable there. Another Chicago dispatch says that "The rush of buying hereabout that many expected a few weeks ago has failed to develop, but trade in all lines is in a good, healthy condition."

The comparative quietude that these and many other items denote has been reflected on the various exchanges, where the volume of trading has been somewhat reduced and the markets have ceased to be responsive to influences that would have excited them two or three months ago. Thus, the Frisco-Rock Island deal has been almost without effect upon the securities of the railroads involved. Sugar stocks compose about the only group that have shown any pronounced strength.

Wheat is undoubtedly in a strong position in so far as the American supply is concerned, but the world's crop is estimated at four billion bushels, and although the exportable surplus in America is small it seems probable that the deficiency will be made up elsewhere. The result is that the market is becoming somewhat difficult to bull.

Rubber has declined about 41 cents from the top, but the American tire companies deny that they are contemplating any reduction in tire prices, although it is rumored that they intend to resort to "spring dating" in an effort to stimulate the demand.

The coffee market declined somewhat from the high prices touched earlier in the week, but consumers continue to buy from hand to mouth.

In the steel industry there has been some slackening in the demand, and slightly lower prices are reported. There is less inquiry for structural steel, and the railroads are now pretty well supplied with all the rails and rolling stock that they are likely to need for some time. Nothing has occurred to disturb the placidity of the copper market, which ranges around 14 cents.

What's Doing in Industry

Machine tool and machinery business continues on the upward trend, the month of January just closed showing a satisfactory volume of business. In fact, many were agreeably surprised at the improvement, and the large number of new inquiries received in the past two weeks indicates a continuation of activity for several weeks to come.

Cincinnati manufacturers report a marked improvement in inquiries and sales, railroads furnishing a good part of current business. Detroit sales have slowed up, but inquiries from automobile manufacturers are quite numerous. Railroads in the Chicago market are active and sales are holding up well.

The New England territory is improving steadily, urgent deliveries being requested on all orders. New York dealers report progress, more inquiries appearing now than in several weeks. Philadelphia business is good, but orders for machinery are slow in closing. The South offers an increasingly active market, all branches of industry being included in the list of prospective buyers of tools.

Export figures for December, 1925, show that the total value of machine tools sent abroad exceeded the value of the previous December by over $600,000. Lathes, gear cutting machines, screw machines, internal grinders and small tools all showed substantial increases.

The general business outlook is satisfactory, with indications that a period of cautious speculation will characterize the immediate future.

In the financial world the statements showing the amount that stock brokers are borrowing are eagerly awaited. Their publication is expected early in February. If the figures should seem unduly large they might be construed as portending liquidation, and the fact that the totals to be published by the Federal Reserve Banks will include the borrowings of the many bond and security houses that are not members of the Stock Exchange may swell the figures beyond the current estimates.

Meantime the Harriman National Bank has published an advertisement urging that the commercial paper sold in the open market should be registered at the Federal Reserve Banks, and that the details of the obligations so registered should be accessible to the member banks. The adoption of this suggestion is unlikely, but it reflects the prevailing disposition to extend the scope of government regulation and it is worthy of consideration.

The foreign loans brought out in the New York market include a large issue of bonds for a German steel trust, a similar issue for a German chain store concern, another for the consolidated municipalities of Baden, including Mannheim and 12 other German cities that have an aggregate population of 516,000, and a munipical loan of $4,000,000 for the city of Oslo in Norway. Several less important foreign loans have been floated, but those mentioned will give an idea of the sort of securities that Europe is now selling in America. As the proceeds of these loans are spent business on both sides the Atlantic will probably be accelerated.

The British Board of Trade publishes an interesting statement in which it is asserted that Great Britain's invisible exports exceed her adverse trade balance for 1925 by $140,000,000, which sum represents England's income available for investment abroad. If these figures are accurate they show that John Bull has been surprisingly successful in triumphing over adversity, and the effect upon business throughout the British Empire has been tonic.

The action of the United States Senate in approving a carefully qualified resolution declaring our adhesion to the world court has also encouraged the internationalists who believe that the political solidarity of the world insures its economic progress.

Taken all in all the outlook is satisfactory, although there are some indications that a period of digestion is now likely to follow the hectic speculative buying that was the outstanding feature in most markets last year.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

Production schedules in the machinery industry of the New England territory, as now planned, call for the best volume that companies have had at a similar period of the year for the past four or five years. Immediate shipment orders are large and early deliveries are being asked.

The situation in the industry is cause for a general belief that the first half of the year will surpass recent records and statements are heard that the prospects up to the first of September are bright.

Orders come from all parts of the country and export business is improving. They call for a diversified assortment of machines and tools and a wide range of sizes. Judged at the production end the bulk of the business is principally for replacement. However, there appears to be an improving condition as far as expansion requirements are concerned.

Selling representatives working out from branch offices report that sales in this territory are improving.

Philadelphia

A large number of inquiries concerning shop equipment has been received from railroad companies by some of the large Philadelphia machine tool establishments, but these inquiries have been slow to develop into orders.

Some dealers and producers take an optimistic view of the situation, while others are concerned over the failure of the trade to respond more readily to the generally good economic conditions which exist. An executive officer of one of the largest machine tool producing concerns announced this week that recently a larger number of inquiries has come from railroad companies than had been received in the last nine months. Virtually none of these, however, has yet developed into orders, it was stated.

Business in the used tool line has been fairly brisk since the beginning of the year, but the response has not been as great as had been anticipated. The material that has moved has been largely small equipment.

Cincinnati

A marked improvement in general conditions and a fair increase in demand were features of the past week, according to Cincinnati machine tool manufacturers. Orders and inquiries received were well scattered geographically and well diversified as to sizes and types of tools.

Selling agents state that there is an increasing tendency on the part of concerns in the metal trades to buy equipment for business expansion. They also state that there is a better market for tools of high efficiency, to be used for the replacement of obsolete types.

Making a composite statement of the reports made by manufacturers of machine tools and by selling agents it is to the effect that "business is looking up," and all expect a continued improvement, gradual in its nature.

Several orders have been booked from railroads and it is reported that other orders from this source have been tentatively agreed upon and only await official confirmation. Five railroads, it is stated, have submitted lists of requirements in the past few days.

The automotive industries did a greater amount of buying than in the previous week. Because of the increased number of inquiries coming in it is thought that the buying from this source will soon be large. Some orders are reported from the oil fields.

Several concerns report that their sales in January of this year were larger than in the same month of the previous year, and also larger than in the average month of the previous year.

New York

The past week has witnessed a large increase in the number of inquiries for machinery and machine tools in this market. Railroads and manufacturers of electrical goods are quite active in seeking equipment, and it is believed that the next month will see some substantial purchasing by these two industries.

January total sales proved quite satisfactory, most dealers reporting a volume in excess of estimates. Also the number of new inquiries has given added strength to the conviction of many that the early months of this year will see a general revival in the machinery trade.

Lathes, large and small, milling machines, planers and radial drills formed the greater part of sales last week. There was also a good demand for miscellaneous small tools, shop equipment and cranes and hoists.

It is true that most orders are for single tools, and many are for special high-production pieces that are to be used to augment present equipment.

The second-hand market is sluggish, few good tools being available, and these being priced too high for the present condition of the market.

Detroit

Sales of machinery and machine tools in Detroit show a trend downward, in spite of an optimistic outlook for the automobile industry this year.

Those representatives of machinery manufacturers in Detroit who are in closest touch with the motor car field are already beginning to feel the decline in sales, a decline which may extend.

Of the larger plants in southeastern Michigan only two, Cadillac and Oakland, are apparently in the market for equipment. Officials of the Cadillac Motor Car Co., although they have given up their plans for a companion line of automobiles to the present job, will be extensive buyers of machinery to be used in bringing production up to a 40,000-a-year basis instead of the 30,000-a-year which Cadillac has been following.

Oakland Motor Car Co. engineers are not entirely satisfied with the equipment used in the manufacture of the new Pontiac, and some extensive purchases are in mind.

Some developments at the Studebaker plant are not at all unlikely in the near future. A recent order amounting to $40,000 called for equipment used in profiling combustion chambers.

The Ford Motor Co. continues to be among the largest buyers of new equipment. Most of the new machines and tools are being used in the motor plant, the pressed steel building, the shop for springs, cranks and steel forgings, and the new steel mill and open hearth furnace.

Orders are being placed for new equipment for the Ford airplane factory at Dearborn which was recently destroyed by fire. The manufacture of Stout all-metal planes is continuing without interruption, however, the work being done in other departments at the Ford plant.

Chicago

Little change is noted in the machine tool market in the past week. Inquiries are fairly satisfactory as to character and volume, but the closing of sales is reported slow. Inventory taking is about over with most concerns, and dealers are looking forward to February business with the expectation that it will show increased activity over the last two weeks in January.

Railroad interests will, it is believed, overshadow all others as prospective buyers during the late winter and early spring, their lists already circulated indicating that purchases of machine tools for shop requirements will be heavy. At the present time, manufacturing industries of a diversified nature are more particularly interested in the market, their inquiries covering a wide variety of equipment, among which punching machines seem to be in largest demand.

The Morgan Gardner Electric Co., the International Harvester Co. and the Continental Motor Co. are among those who are expected to place substantial orders shortly. Others among inquirers are the Coeur d'Alene Hardwood and Foundry Co., Wallace, Idaho; the Bliss Supply Co., Cleveland, Ohio; and the Ellwood City Forge Co., Ellwood, Pa.

Southern District

Though inquiries have picked up in the past two weeks, orders for machinery and equipment in the Atlanta district have not increased. The month as a whole has proved satisfactory, slightly better than January, 1925, while the outlook for February and March is very promising, most dealers seeming to think the first quarter this year will establish one of the best sales records the industry has enjoyed in the past four or five seasons.

The lumber and woodworking industries, particularly the furniture factories in the East Tennessee, Georgia, Florida and North Carolina territory, have been buying on a good basis since the first of the year. There is some business reported in road building machinery, but as yet this trade has not opened up on a really active basis.

Textile mill demand is only fair, but inquiries are good and there is promise of more active buying later. Smaller shops and service stations are in the market for a fair amount of equipment, principally used and rebuilt machinery. Inquiries from this source are also active and promise to develop some good business in the next few months. The outlook for contractors' equipment is also very good, as another big construction year seems in prospect for the South.

Inquiries for heavier equipment from the railroads in the Southeast have improved steadily since the first of the year, but have not as yet developed any real business.

Tractor sales are also expected to prove good this year, exceeding the 1925 business which was 40 to 50 per cent better than 1924.

Personals

WILLIAM FAIRHURST has been appointed manager of the Spicer Manufacturing Corporation.

PETER C. POSS has been appointed assistant advertising manager of the Timken Roller Bearing Co., Canton, Ohio.

JOHN IRWIN has been appointed maintenance engineer for the Remy Electric Co., of Muncie, Ind.

C. H. BEAUMONT has been appointed assistant general manager of the Lexington Motor Car. Co.

THOMAS O'BRIEN has resigned as sales engineer for the John F. Allen Co., of New York. He will establish a business of his own.

R. W. BALLENTINE has been appointed assistant manager of sales in the automotive division of the Timken Roller Bearing Co., Canton, Ohio.

H. S. DURANT has been appointed manager of the cold rolled strip and the spring sales departments of the American Steel and Wire Co., of Chicago.

C. B. OSTRANDER has resigned as superintendent of the Ford plant at Charlotte, N. C., and has returned to Detroit as an executive in the main factory of the Ford Motor Co.

R. L. LEONARD has been elected president of the F. B. Stearns Co., of Cleveland, manufacturer of automobiles. He was formerly vice-president and general manager of the Stephens Motor Car Co.

A. H. TISCHER has joined the engineering staff of the Foote Bros. Gear and Machine Co., of Chicago. Mr. Tischer has charge of the designing of the new line of herringbone speed reducers.

WALTER C. WICKER, formerly associated with the Altorfer Bros. Co., has been appointed sales manager of the Tuec installed cleaner division of the United Electric Co., of Canton, Ohio.

HARRY A. DURYEA has been appointed sales manager of the portable cleaner division of the United Electric Co., of Canton, Ohio. He was formerly regional sales director.

ALBERT V. BRONILLETTE has resigned as industrial engineer for the Westinghouse Electric and Manufacturing Co., and has accepted a similar position with the Savage Arms Corporation at Utica, N. Y.

HERBERT SMITH has been appointed general superintendent of the Empire Brass Manufacturing Co., Ltd., of London, Canada. He succeeds A. J. Palmer, who resigned.

GEORGE D. SHANAHAN, formerly vice-president of the J. W. Murray Manufacturing Co., has been appointed assistant general manager of the Motors Metal Manufacturing Co., of Detroit.

J. F. CARPER has joined the steam railroad department of the Electric Service Supplies Co., Chicago. Since 1920 he has been with the Galesburg Machine Works and the Atchison, Topeka & Santa Fe Railroad.

L. M. COWDREY has severed connections with Frazar & Co., of New York. Jose Simao Portugal, until recently in charge of the company's business in Brazil, has returned to the United States and will have charge of the South American department, succeeding Mr. Cowdrey.

C. G. DUNKLE, secretary of the Pittsburgh Section of the American Chemical Society, and formerly associated with the H. J. Heinz Co., has been appointed to a research fellowship in mining and metallurgy at the Carnegie Institute of Technology.

J. E. WHITBECK, who has been superintendent of the Eastern Division of the Air Mail Service, is now associated with William E. Arthur & Co., aeronautic engineers and builders. Archibald Black has also joined the engineering staff of this company and will have charge of the designing and building of landing fields.

HARRY LANDSIEDEL, vice-president and general manager of the Dalton Adding Machine Co., of Cincinnati, has been elected president of the company to succeed the late James L. Dalton. Mr. Landsiedel has been associated with the Dalton company for the past 21 years.

HOWARD U. HERRICK, formerly vice-president and general manager of the V & O Press Co., Hudson, N. Y., has been elected president of that company to succeed William P. Jeffrey, who has resigned in order to devote his entire time to his legal work. Previous to joining the V & O Press Co., about two years ago, Mr. Herrick was works manager of the Brown-Lipe Gear Co., at Syracuse, N. Y.

Business Items

The Toledo Milling Machine Co., of Toledo, Ohio, has gone into the hands of a receiver.

The Hannum Manufacturing Co. has opened a branch office in the General Motors Bldg., Detroit.

The Griscom-Russell Co., of New York, has moved its main offices from 90 West St., to 285 Madison Ave.

The American Electric Corporation has been organized in Delaware to take over the business of the Belding Hall Co., of Michigan, manufacturer of refrigerating machinery.

The Sidney B. Roby Co., of 208 South Ave., Rochester, N. Y., has been appointed sales agent in Monroe County, N. Y., for the Geometric Tool Co., of New Haven, Conn.

The Strom Division of the Marlin-Rockwell Corporation, of Chicago, has moved its Philadelphia office to 1211 Franklin Trust Bldg., 15th and Chestnut Sts. A. W. Wiese is in charge of this territory.

The De Luxe Metal Furniture Co. has been organized at Warren, Pa. It is planned to purchase the old Gisholt plant, near Warren, and begin at once the manufacture of metal products.

The Townsend Co., of New Brighton, Pa., is celebrating its one-hundred and tenth anniversary in business. This company, organized in 1816 as R. Townsend & Co., has been engaged in the manufacture of nails, rivets, wire and wire products continuously.

The Standard Electrica Sociedad Anonima has been organized in Spain to manufacture telephone apparatus and equipment. The new company will be affiliated with the International Standard Electric Corporation and the International Telephone and Telegraph Corporation.

The Sheet Aluminum Corporation, of Jackson, Mich., has started the operation of a rolling mill at Jackson and will produce a full line of sheets. W. J. Moore, president of the Allied Metal Products Corporation, of Detroit, is vice-president and sales manager of the company.

The Diamond State Fibre Co., of Bridgeport, Pa., announces the following changes in its branch office staff: C. M. Bogert is now district manager for the state of Connecticut with offices in South Norwalk; W. R. Elsenhans is now district manager at Philadelphia, with offices in the Drexel Bldg.

The plant of the Boye & Emmes Machine Tool Co., at 2245 Spring Grove Ave., Cincinnati, was completely destroyed by fire early on the morning of Jan. 27. The cause of the fire is unknown. W. T. Emmes, vice-president of the company, estimates that the loss of the plant, raw material and finished product will exceed $500,000. It is stated that the plant will be rebuilt at once.

The Loshbough-Beck Press Co. has been organized at Elkhart, Ind., to manufacture a complete line of open-back, inclinable presses. Officers of the new company are J. E. Loshbough, president and general manager; L. E. Loshbough, vice-president; and H. M. Beck, secretary and treasurer. J. E. Loshbough was formerly president and half owner of the Loshbough-Jordan Tool and Machine Co., and has sold his interest in that company and will devote his time to the development of the newer organization.

Obituaries

GEORGE HAISS, president of the George Haiss Manufacturing Co., of New York, died in that city on Jan. 11.

DR. HERMAN L. KELLNER, head of the scientific staff in the optical division of the Bausch & Lomb Co., died in Rochester, N. Y., on Jan. 28. He was 52 years old.

ARTHUR R. BUSH, manager of the industrial department of the General Electric Co., died at his home in Schenectady on Jan. 24.

WALTER M. WELLMAN, president and treasurer of the American Tube Bending Co., of New Haven, Conn., died in that city on Jan. 2. He was 67 years old.

EVERETT B. SMITH, formerly purchasing agent for the Canadian Car and Foundry Co. Ltd., died in a Montreal hospital on Dec. 27, after an illness of some months. He was 34 years old.

RICHARD CURZON HOFFMAN, for many years engaged as an iron merchant, died on Jan. 21 at his home in Baltimore, Md. He was 86 years old. Mr. Hoffman in 1866 formed the firm of Hoffman, Thompson & Co., iron commission merchants. The business later became R. C. Hoffman & Co. Mr. Hoffman was made vice-president of the Seaboard Air Line in 1888, and president in 1893. He was also identified with the Maryland Steel Co.

WILLIAM WARREN BIRD, formerly head of the mechanical engineering department of the Worcester Polytechnic Institute, Worcester, Mass., died on Jan. 24 at his home in that city. Mr. Bird was born in Somerville, and graduated from the Worcester Polytechnic Institute in 1887. His father organized the Broadway Iron Foundry, and as a young man Mr. Bird was connected with the company. Later he succeeded to the presidency of the concern.

Trade Catalogs

Arc Welding Sets. General Electric Co., Schenectady, N. Y. Circular GEA-9 describes the General Electric arc welding sets using the WD-12 generator and a motor engine, model WTU. Full details are given of both the engine and of the generator. Illustrations include detailed views of the electrical equipment and a cross-section of the engine.

Ball Bearings. New Departure Manufacturing Co., Bristol, Conn. A four-page circular has been issued by this company showing views of some of the 75 major inspections of New Departure ball bearings. These views show the checking, testing and gaging of the bearings.

Controllers, Crane. Allen-Bradley Co., Milwaukee, Wis. Bulletin No. 330 describes the type F-2250 crane hoist and mill controller. The eight pages of the bulletin contain many views of the various units of the controller and paragraphs devoted to each of the various details of construction. The descriptions are full and thorough.

Cutters, Milling. Reed-Prentice Co., Worcester, Mass. Milling cutters and collets for the Nos. 1, 2 and 2A vertical milling machines are described and the sizes listed in circular 27-200-1. Illustrations are given of each type described. Many types of engravers' cutters are also illustrated.

Electrical Equipment. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This company has published a 44-page, 8½ x 10½-in. booklet entitled "The Engineering Achievements of the Westinghouse Electric & Manufacturing Company for the Year 1925." This was prepared by H. W. Cope, the assistant director of engineering of the company. The intention of the author was to cull the more interesting and important developments mad during the year 1925 and to group them in this one work. They are arranged under the following titles: Generation and Distribution of Power, including steam turbines, conductors and stokers; Transportation; The Industries; Radio; Illumination

and Miscellaneous. The section on Transportation includes machine equipment, electric auxiliaries, aeronautics, railways, self-contained locomotives and cars and light traction. Interesting photographs have been chosen to illustrate the text.

Gear Shapers. The Fellows Gear Shaper Co., Springfield, Vt., has published a booklet entitled "Put Money in Your Purse." Its style represents a departure from the usual arrangement of catalogs, both in the type and in the engravings. The perspective drawings used to illustrate the text are attractive and carefully executed. The entire makeup of the booklet is artistic and well balanced.

Its thirty-two, 6x9-in. pages are devoted to a comparison of methods in the production of special and unusual gears and pinions. Eighteen jobs are discussed, each on a separate page. The time saving over a previous method of production is shown, as well as the volume and cost records secured on Fellows gear shapers.

Grinding Machines, Internal. The Heald Machine Co., Worcester, Mass. To commemorate its 100th anniversary, the Heald Machine Co. has published an historical sketch showing the development of the company from its earliest days. The covers of the booklet are made in facsimile of the first ledger of Stephen Heald, the founder of the business. The frontispiece is a photograph of Heald Village, Mass., taken in 1860, at which place the Heald business was first established January 7, 1826. Views are shown also of the first Worcester plant of 1903 and of the present plant. Facsimile pages of the original ledger make possible an interesting comparison of the money values of time and materials in 1826 with those of the present day. The subjects of the different sections of the book are: One Hundred Years of Machine Building; Putting Quality in the Heald Products; The Present Heald Organization; The Heald Line, which represents a comparison of some of the earlier and latest models; and a page devoted to the personnel of the organization. Thirty-two 6 x 9-in. pages are contained in the booklet.

Heating Equipment, Electrical. General Electric Co., Schenectady, N. Y. Bulletin GEA-261, entitled "Electric Heat in Industry" contains thirty-two, 8 x 10-in. pages with illustrations of heating equipment as applied to various industries. Seven pages are devoted to the industrial advantages of electric heat in general, and the remainder of the booklet is devoted to the equipment to be used in the various industries in particular. These include the metal industries, the sub-titles being aluminum, brass, copper, steel, annealing, carburizing or case-hardening, annealing cast iron, smelting, hardening and tempering and electric welding. The next industry is the ceramic, with sub-titles, firing china, vitreous enameling. Photographs show some of the equipment used. Other industries in which the equipment has been applied are the chemical, the printing and the food industries. Other applications of the equipment are finishing processes, branding, melting glue, impregnating processes, power feeding processes, laundries, shoes and leather, soldering, baking of abrasives, melting compounds and soft metal.

Keyway Machines. The Ingersoll Milling Machine Co., Rockford, Ill., has published a circular on the Ingersoll keyway machine. Two views are shown of the machine, and the possibilities and capacities of the machine are discussed.

Presses, Hydraulic. Lourie Manufacturing Co., Springfield, Ill. Illustrations of many types of Lourie hydraulic presses are shown on circular No. 151. These represent models for forcing, broaching, punching, molding and forming operations.

Rail Bond Testers. Roller-Smith Co., 233 Broadway, New York, N. Y. Bulletin No. 200 is devoted to the Roller-Smith testing equipment designed primarily for the testing of rail bonds. The apparatus is portable and direct reading.

Saws. The Huther Bros. Saw Manufacturing Co., Inc., Rochester, N. Y., has issued catalog No. 46 containing 104 5 x 6¾-in. pages. The equipment listed includes various types of inserted-tooth and solid-tooth saws, special cutters, cylinder cutter heads, planer knives and band saws as well as saw grinders, circular knives, saw files and filing machines, saw swedges and various types of files.

Starters, Automatic. Allen-Bradley Co., Milwaukee, Wis. This company has published Bulletin No. 215 on its type D-1220 automatic, d.c., limit starter for machine tool service or similar applications. Several illustrations are used in the text.

Switching Equipment, Automatic. General Electric Co., Schenectady, N. Y., Bulletin GEA-295 contains twenty-four 8 x 10½-in. pages. It is well illustrated and describes the application of this equipment to railway service, hydro-electric generators, mining and industrial service and central service stations.

Trucks and Tiering Machines. The Lewis-Shepard Co., Watertown Station, Boston, Mass., has published its 1926 catalog on jack lifts, stackers and lift-truck platforms. Many illustrations are shown of the equipment in use in various plants. These are arranged in order according to the alphabetical list of industries in which they are used. The points of construction are shown in detailed views of the equipment. The catalog is assembled in a patented tab cover for convenient filing in a letter-file.

Pamphlets Received

Oxy-Acetylene Tips for the Linde Oxwelder. Published monthly by the Linde Air Products Co., 30 East 42nd St., New York, N. Y. The publishers of this monthly announce that "The Linde Oxwelder" has been combined with "Oxy-Acetylene Tips." The former was originally intended for small welding or repair shops while the latter was intended for engineers, superintendents and foremen. Subscribers to either of the two papers will receive the "Oxy-Acetylene Tips for the Linde Oxwelder" which will cover the original fields of both publications.

Methods of Compensating Drivers. No. 5 on "Methods of Compensation." Published by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y. Subjects considered are: the driver as a salesman, types of incentive plans and their practicability, and bonus plans for drivers with items listed on which the merits of the drivers can be based.

Calendar of Local Meetings

National Association of Cost Accountants

New York. Feb. 9. Machinery Club. "Financing a Business."

Albany. Feb. 10. "Accounting for Selling, Administrative and Financial Expenses."

Worcester. Feb. 11. "The Marginal Line of Production."

Philadelphia. Feb. 12. Bellevue-Stratford Hotel. "Industrial Insurance."

Mohawk Valley. Feb. 15. "Plant and Equipment Budgets."

Twin Cities. Feb. 16. "Taxes as a Cost."

Hartford. Feb. 16. Visit to plant of Hartford Rubber Works; dinner and meeting in evening.

Los Angeles. Feb. 16. "Income Tax," by R. B. Goodsell, collector of Internal Revenue.

Rochester. Feb. 17. "Administrative and Selling Costs," by W. B. Castenholz.

Syracuse. Feb. 17. "Cost Information from the Foreman's Viewpoint."

Chicago. Feb. 18. City Club. "Planning for Reduced Production Costs."

Milwaukee. Feb. 19. "Standard Classification of Accounts."

San Francisco. Feb. 22. "How Can the Engineer and the Cost Accountant Co-operate for Better Management?"

Scranton. Feb. 23. Scranton Club. "Changes in the 1925 Revenue Act."

Boston. Feb. 25. "Some Debatable Points in Cost Accounting," by Clinton H. Scovell.

Buffalo. Feb. 25. "Distribution Costs."

Detroit, Feb. 25. "Computing and Distributing Power Costs."

American Society for Steel Treating

Hartford. June. Spring sectional meeting.

American Society of Mechanical Engineers

Metropolitan. Feb. 5. Joint meeting with the Taylor Society and the New York Railway Club.

Toronto, Ontario. Feb. 8. "A Travelogue on South America," by Calvin W. Rice, secretary of the A. S. M. E.

New Haven. Feb. 9. "Engineering in Japan," by Elmer A. Sperry, of the Sperry Gyroscope Co.

Buffalo. Feb. 9. "Czechoslovakia," by Calvin W. Rice.

Brooklyn, N. Y. Feb. 10. "Machine Shop Practice."

Eastern New York, at Schenectady. Feb. 12. Joint meeting with the A. I. E. E. Speaker, Mr. Eveleth, of the General Electric Co.

Society of Automotive Engineers

Pennsylvania Section. Feb. 9. "Servicing Problems in Connection with Bus Operation," by A. E. Hutt.

Detroit Section. Feb. 11. Paper by T. J. Little, Jr.

Indiana Section. Feb. 11. "Oil Rectifiers and Crankcase Dilution," by R. L. Skinner, Col. Wm. G. Wall and J. C. Coulombe.

Southern California Section. Feb. 12. "Engine Cooling by Radiators and Steam Cooling Systems," by G. A. Dockeray and Paul Zering.

Cleveland Section. Feb. 15. "Automobiles of Today and Tomorrow," by Herbert Chase.

Metropolitan Section. Feb. 18. "The Outlook for Bus Transportation in New York City," by F. V. Lane, D. J. Locke and Alexander Shapiro.

Chicago Section. Feb. 19. "Soothing the Internal Combustion Engine," by Professor Daniel Roesch.

Buffalo Section. Feb. 23. "Progress in Airplane Engine Design," by Arthur Nutt.

Detroit Section. Feb. 25. "Airplane Engine Maintenance," by Lieut. Cyrus Bettis.

Forthcoming Meetings

American Management Association. Annual convention, Hotel Astor, New York City, March 3, 4 and 5. Headquarters, 20 Vesey St., New York City.

National Railway Appliance Association. Annual meeting and exhibition, Coliseum and Annex, Chicago, March 8 to 11th. C. W. Kelley, secretary, 845 So. Wabash Ave., Chicago.

National Foreign Trade Council. Thirteenth national foreign trade convention, Charleston, S. C., April 28, 29 and 30. O. K. Davis, secretary, India House, Hanover Square, New York.

American Gear Manufacturers' Association. Tenth annual meeting, Book-Cadillac Hotel, Detroit, May 13, 14 and 15. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association. Annual convention, Hotel Statler, St. Louis, week of May 17. F. D. Mitchell, secretary, 1819 Broadway, New York.

National Association of Purchasing Agents. Eleventh annual convention and exposition, Ambassador Hotel and Auditorium, Los Angeles, Calif., June 9 to 12. W. L. Chandler, secretary, Woolworth Bldg., New York.

American Society for Testing Materials. Twenty-ninth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Considerable improvement over a week ago is noted in the pig-iron market; prices remain unchanged. While the general tendency in steel is toward slightly lower prices, there is firmness in shapes, bars, bolts, nuts, and sheets. Steel plates range from $1.80 to $1.90 per 100 lb., Pittsburgh, with $1.60 mentioned; bars are $2 and shapes, $1.90@$2 per 100 lb., in carload lots at mill. Foundry coke rose 50c. per ton during week. Compared with price levels of eight months ago, black and galvanized sheets are up 15c. and cold rolled strip steel is 10c. per 100 lb. lower.

Non-Ferrous Materials—Slight weakness developed during the week in copper, tin and zinc; other metals held firm. Declines were noted in solder, babbitt metal, non-ferrous scrap, and linseed oil.

(All prices as of Jan. 28)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	22.00@23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.16
Virginia No. 2	29.17
Basic	23.16
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.27
Basic	22.27
Bessemer	22.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50	3.89	3.25	3.50
No. 12	2.55	3.94	3.30	3.55
No. 14	2.60	3.99	3.35	3.60
No. 16	2.70	4.09	3.45	3.70
Black				
Nos. 18 to 20	3.15	4.30	3.90	3.90
Nos. 22 to 24	3.20	4.35	3.95	3.95
Nos. 26 and 27	3.25	4.40	4.00	4.00
No. 28	3.35	4.50	4.10	4.10
Galvanized				
No. 10	3.60	4.50	4.25	4.25
Nos. 12 to 14	3.70	4.60	4.35	4.35
No. 16	3.85	4.75	4.50	4.50
Nos. 18 to 20	4.00	4.90	4.65	4.65
Nos. 22 to 24	4.15	5.05	4.85	4.80
Nos. 26 and 27	4.30	5.20	5.10	4.95
No. 28	4.60	5.50	5.25	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness B.W.G. and Decimal	Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	⅝	1	1½	1¼
		Price per Foot							
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23	
.049″	18	.17	.18	.19	.20	.21	.23	.25	
.065″	16	.19	.20	.21	.22	.23	.25	.27	
.083″	14	.20	.22	.23	.24	.25	.27	.29	
.095″	13	.21	.23	.25	.26	.27	.29	.31	
.109″	12	.22	.24	.26	.27	.28	.30	.32	
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33	
.134″	10	.24	.26	.28	.29	.30	.32	.34	

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.25	6.35	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	50@60%	55%	60%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to 3/16, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York				15.00
Tin, 5-ton lots, New York				63.00
Lead (up to carlots) E. St. Louis	9.10	New York		9.75
Zinc (up to carlots) E. St. Louis	8.05	New York		9.50

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	25.00	24.50	26.00
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.62½	16.50	16.25@16.50
Copper bars, base	22.12½	22.37½	22.12½
Copper tubing, base	24.50	24.50	24.50
Brass sheets, base	19.12½	18.87½	19.12½
Brass tubing, base	23.75	23.50	23.75
Brass rods, base	16.87½	16.62½	16.87½
Brass wire, base	19.62½	19.37½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	12.00	12.60@12.95	12.27
Solder (½ and ½), (case lots)	39.75	41.00	38@42

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	79.00
Commercial genuine, intermediate grade	56.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	14.50

Nickel, f.o.b. refinery, cents per lb.:
Ingots..... 31.00 Electrolytic.. 38.00 Shot..... 32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00@12.25	11.25	11.25@11.75
Copper, heavy, and wire	11.50@11.75	11.50	11.00@11.50
Copper, light, and bottoms	9.50@10.00	9.50	10.00@10.50
Heavy lead	8.00@8.37½	7.50	7.75@8.25
Tea lead	6.25@6.50	5.00	6.75@7.25
Brass, heavy, yellow	7.25@7.75	7.25	7.50@8.00
Brass, heavy, red	9.50@9.75	9.50	8.50@9.00
Brass, light	6.00@6.50	6.00	7.00@7.50
No. 1 yellow rod turnings	8.50@9.00	8.00	7.50@8.00
Zinc	4.75@5.25	4.75	5.00@5.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.85	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@.15½	.10	.17
Wiping cloths, washed white, per lb	.18	36.00 per M	.16
Sal soda, per 100 lb. keg	2.25	2.25	2.75*
Roll sulphur, per 100 lb. keg	3.75	3.35	4.50
Linseed oil, per gal., 5 bbl. lots	.89½	1.05	.90
Lard cutting oil, 25% lard, per gal.	.55	.50	.56
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1687½	.1687½	.1762½
Solder (½ and ½)	per lb.	.3975	.4025	42½@43½
Cotton waste	per lb.	.15@.22	.15@.22	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.60
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40–5%	40–5%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		9.50@10.00
Coke, prompt foundry, Connellsville	per net ton		10.00@10.50
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ¼-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb for 1¼ to 2-in. long, all diameters, 25c.; ¾-in. dia., 35c.; ⅞-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Putnam — Trade School — drills, lathes and miscellaneous machine tools for proposed addition to State Trade School. Estimated cost $25,000.

Ill., Chicago—Donahue Steel Products Co., 204 North Jefferson St.—1¼ in. Acme upsetter, trimming presses, bulldozers, tappers, threading machines, cold headers, double and single end punches and drop hammer.

Ill., Springfield—Weaver Mfg. Co., 2171 South 9th St.—bulldozer.

Mass., Boston—H. Bettoney, 106 Chestnut Ave.—6 or 7 upright drill presses, single spindle, belt drive 14 in.

Mich., Bay City — The Jennison Hardware Co.—squaring shear, lap 72 in. ⅜ to ½ in. thick.

Mich., Detroit — Bd. of Education, 1354 Broadway Ave., C. A. Gadd, Bus. Mgr. — drill press ½ in. capacity; ½ hp. 1750 r.p.m. motor; three 3 in. drill press vises; twenty-four 3½ in. plain, vises, stocks and dies, Ford piston pin reamer, four easy cut stud removers, Cleve No. 4, 1 gross drills, combination, countersink E. 2, etc.

Mich., Wayland—C. D. Averill—sheet metal working machinery.

Mo., St. Louis—City, E. E. Wall, Director machine shop equipment, etc. Estimated cost $525,000.

Mo., St. Louis—St. Louis-Southwestern R.R., Buder Bldg., Seventh and Market Sts., E. O. Griffin, Purch. Agt.—shop machinery and tools. Estimated cost $300,000.

N. C., Wilmington—O. Carter—screw cutting engine lathe with chuck and all equipment, 16 in. swing, 10 or 12 ft. bed.

O., Columbus—Connors Hoe & Tool Co., 39 East Northwood Ave., T. F. Connors, Pres. and Gen. Mgr.—two 24 in. lathes and special machinery.

O., Toledo—Reliable Welding Co., 436 Ohio Bldg., R. Krebs, Pres. and Gen Mgr.—general welding equipment.

Wis., Milwaukee — Central Bd. of Purchases, City Hall, J. W. Nicholson, Ch. Buyer—16 in. tool room lathe, 30 in. geared head engine lathe, 30 in. ball or roller bearing grinder, tool room sensitive drill.

Wis., Milwaukee—Forest Home Chevrolet Co., 970½ Forest Home Ave. (garage)—tool room lathe, grinder, air compressor, gasoline pumps, etc.

Wis., Racine—Walker Mfg. Co., Hamilton St. and Michigan Blvd.—foundry equipment for proposed 1 story, 92 x 121 ft. addition to foundry on Hamilton St. Estimated cost $40,000.

Ont., Fergus — Beatty Bros. — equipment for proposed 72 x 134 ft. galvanizing department. Estimated cost $25,000.

Que., Montreal—White Co. Ltd., 3429 Park Ave.—complete equipment for proposed 2 story, 150 x 185 ft. garage and repair shop and service station on De Garpe St.

Opportunities for Future Business

Calif., Fresno—O. R. Osterode, 1717 Van Ness Ave., is having plans prepared for the construction of a 1 story, 75 x 140 ft. machine shop and upholstering shop at 1117 North St. Estimated cost $11,000. Private plans.

Calif., Oakland—Electric Products Corp., 1212 Mission St., electric sign manufacturers, awarded contract for the construction of a 1 story factory at 30th and Myrtle Sts. $40,000. Noted Jan. 28.

Calif., Petaluma—Murphy Chevrolet Co., is having plans prepared for the construction of a 1 story, 50 x 175 ft. garage and machine shop on Main St.

Calif., Sacramento—Schaw Pipe & Steel Works, 16th and North B Sts., awarded contract for the construction of a 1 story, 100 x 160 ft. pipe plant annex. $10,000.

Calif., San Francisco—Herman Safe Co., 216 Fremont St., awarded contract for the construction of a 1 and 2 story, 137 x 137 ft. factory at Main and Howard Sts. $86,975. Noted Dec. 3.

Calif., San Francisco—J. Jerome, 321 Bush St., awarded contract for the construction of a 2 story garage at 3rd and Folsom Sts. $175,000.

Conn., Bridgeport—Bead Chain Co., State St. awarded contract for the construction of a factory at State St. and Mountain Grove. Estimated cost $50,000.

Conn., Hartford—J. P. Nielsen & Son Co., 86 Maple St., plans the construction of a 2 story, 96 x 300 ft. garage on Washington St. Estimated cost $150,000. Private plans.

Conn., Hartford—Nirenstein & Schwartz, North Main St., is having plans prepared for the construction of a 1 story, 61 x 154 ft. garage and repair shop. Estimated cost $40,000. Berenson & Moses, 30 Allyn St., Archts.

Conn., Torrington—Progressive Mfg Co., 52 Norwood St., manufacturers of machine screws, rivets and specialties, plans the construction of a 2 story, 55 x 141 ft. factory. Estimated cost $40,000. W. E. Hunt, 182 Church St., Archt.

Fla., Miami—City plans an election to vote $445,000 bonds for the construction and equipping of a building for storage, repair and maintenance of municipal vehicles, equipment and supplies.

Ill., Chicago — Jewell Electrical Instrument Co., 1650 Walnut St., manufacturers of voltmeters, ammeters, etc., will receive bids until Feb. 6 for the construction of a 2 story, 75 x 100 ft. addition to factory. Estimated cost $40,000. F. A. Randall, 160 North La Salle St., Engr.

Ky., Hopkinsville—Forbes Mfg. Co. plans the construction of a wagon plant to replace fire loss. Estimated cost $500,000. Noted Jan. 14.

La., New Orleans—The Equitable Equipment Co., N. Levy, V. Pres., has purchased the United Chemical Organic Products Co. plant at Florida wall and Louisville and Nashville R.R. tracks, and plans to convert buildings into machinery shops and warehouses. Estimated cost $100,000.

Mass., Charlestown (Boston P. O.) — J. D'Este, 26 Canal St., Boston, awarded contract for the construction of a 1 story, 50 x 95 ft. foundry on Spice St. here. Estimated cost $40,000.

Mass., Medford (Boston P. O.)—W. F. Lacey & Sons, Mystic Ave., awarded contract for the construction of 1 and 2 story, 65 x 100 ft. factory and blacksmith shops. Estimated cost $40,000.

Mich., Detroit — Eaton Axle & Spring Corp., 65th and Central Aves., Cleveland, O., has acquired a 15 acre site and plans the construction of a factory at French Road and Grinnel Ave. here. Estimated cost $1,228,000.

Mo., Kansas City—J. Goldberg & Sons, 800 East 18th St., plans extensions to foundry and machinery plant. Estimated cost $200,000.

Mo., St. Louis—A-C Brake Shop, 2739 Locust Blvd., auto brake manufacturers, awarded contract for the construction of a 1 story, 125 x 135 ft. factory.

Mo., St. Louis—St. Louis-San Francisco Ry. Co., Frisco Bldg., is having preliminary plans prepared for the construction of a group of shop buildings, etc. Estimated cost $210,000. Total estimated cost $21,000,000. F. G. Jonah, Frisco Bldg., Ch. Engr.

Mo., Sedalia—Missouri Pacific R.R., Railway Exchange Bldg., St. Louis, awarded contract for the construction of a 1 story, 65 x 120 and 40 x 550 ft. reclamation plant. Total estimated cost $125,000.

O., Akron—North High Street Garage, W. Piedmore, Pres., is having plans prepared for the construction of a 2 story, 65 x 107 ft. garage and auto sales room. Estimated cost $150,000. F. F. Hodges, Hickox Bldg., Cleveland, Archt.

O., Cincinnati—Dreses Machine Tool Co., 227 West McMicken Ave., awarded contract for the construction of a 1 story, 90 x 300 ft. machine shop at Spring Grove. Estimated cost $100,000.

O., Cleveland — The Cleveland Automobile Co., J. J. Krall, Secy. and Treas., London Road, had revised plans prepared for the construction of a 4 story addition to factory. Estimated cost $200,000. E. McGeorge, 3030 Euclid Ave., Archt. and Engr. Noted Jan. 28.

O., Cleveland — J. Roemer, Rose Bldg., heating contractor, plans the construction of a 4 story, 81 x 130 ft. factory on East 22nd St. Estimated cost $150,000. Architect not selected.

O., Euclid—The Austin Co., W. J. Austin, Pres., 16112 Euclid Ave., East Cleveland, will build a 1 story, 75 x 300 ft. steel fabricating plant on Bliss St. Estimated cost $50,000. Private plans.

Okla., Cardin—A. Beaver Mining Co. had plans prepared for the construction of a 1 story, 160 x 270 ft. steel ore reduction mill complete with pulverizing machinery for handling zinc ore. Estimated cost $160,000. G. Stein, Miami, Engr.

Okla., Oklahoma City—Buick Motor Co., 504 North Broadway, awarded contract for the construction of a 4 story, 75 x 140 ft. garage at 10th St. and Broadway. Estimated cost $200,000. Noted Dec. 3.

Pa., Bristol—Pacific Steel Boiler Corp., Waukegan, Ill., has acquired a 15 acre site and plans the construction of a 1 story factory here. Estimated cost $300,000. Engineer not selected.

Pa., Chester — Ford Motor Co., B. R. Brown, Eng. Dept., Highland Park, Mich., awarded contract for the construction of a group of buildings including car delivery shop, assembling building, etc., here. Estimated cost $2,000,000. Noted Nov. 12.

Pa., Philadelphia—Duff Nash Motor Co., 1113 South Broad St., awarded contract for the construction of a 3 story, 86 x 100 ft. sales and service garage at Broad and Washington Sts. Noted Dec. 31.

Pa., Philadelphia—A. Ealbus, c/o Ballinger Co., Twelfth and Chestnut Sts., Archt., will receive bids until Feb. 9 for the construction of a 4 story, 68 x 239 ft. garage and service station. Estimated cost $250,000.

Tex., Orange—Orange Car & Steel Co., J. I. Byrne, Mgr., is having plans prepared for the construction of addition to plant to increase the capacity 1,000 tons daily. Estimated cost $70,000.

Wis., Janesville—C. H. Cox, 509 Monroe St., will build a 1 story, 42 x 100 ft. assembling plant on Industrial Ave. Private plans.

Wis., West Allis—Wehr Steel Co., 45th and Gordon Aves., awarded contract for the construction of a 1 story, 160 x 200 ft. foundry.